THE EFFECTS OF OPERATING A PIPELINE **WITHOUT** ISOLATION

Isolation plays a vital piece in the fight against corrosion. However, isolation in a cathodic protection system is not always used, isolation kits may malfunction, and/or an isolating kit may be found to not be isolating and might be replaced by a non-isolating gasket. What effect on the piping system, personnel and costs does this have?

Isolating a pipeline optimizes the performance of a cathodic protection system. It can help confine cathodic protection current within a specified area and direct the electrical energy to the area intended to be protected. Isolation can significantly optimize the efficacy of the cathodic protection system and can minimize the effects of stray current. It can also isolate dissimilar metal connections and mitigate the galvanic corrosion rate of that connection. However, it is not always possible to have all isolating points isolating at any given time.

This paper will delve into the cause/effect analysis when isolation is not part of the cathodic protection package (whether intentional or unintentional). The primary effects are:

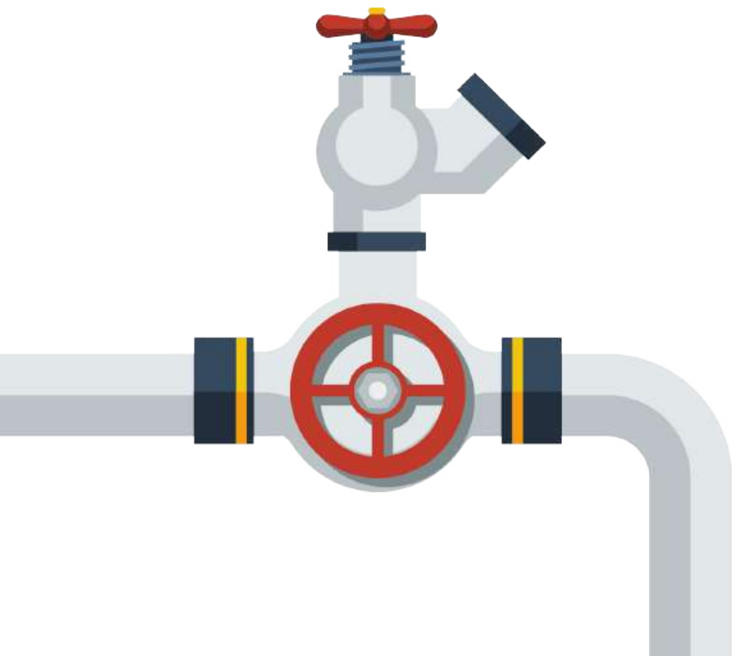
01 Increased electrical costs
02 Increased likelihood of hydrogen induced corrosion
03 Potential for electrically induced coating disbondment
04 Increased potential for stress corrosion cracking
05 Greater potential for current to stray to and from pipeline
06 Potential for unsafe electrical exposure for personnel

This paper will capture issues with the elimination of isolation and present why these problems are eliminated by using a proper isolation kit.

Key words: stray current, stress corrosion cracking, flange isolation, isolation kit, hydrogen induced corrosion, HIC, SCC, coating disbondment, stray current, unsafe electrical, electrical costs, electrical safety

INTRODUCTION

Isolating a pipeline optimizes the performance of a cathodic protection system. It can help confine cathodic protection current within a specified area and direct the electrical energy to the area intended to be protected. Isolation can significantly optimize the efficacy of the cathodic protection system and can minimize the effects of stray current. It can also isolate dissimilar metal connections and mitigate the galvanic corrosion rate of that connection. However, it is not always possible to have all isolating points isolating at any given time. A survey of oil and gas companies around the world has shown that many are operating with 20% to 50% of their isolation connections in an unintentional, non-isolated state at any given time. Many operators know that the cathodic protection current must be increased when isolation isn't functional, but the effects reach well beyond an increase in electrical usage. Without knowing the total effects, the replacement of failed isolation kits can be significantly prolonged or even left in the pipeline indefinitely. There are even some rare companies that choose not to use isolation with their cathodic protection systems.



It is acknowledged the loss of isolation at times is possibly inevitable and operators may continue operating without it in a specific locale or in some cases operate without any isolation in the whole pipeline. Unfortunately, there are also companies that believe isolation is functioning properly, but due to a lack of proper testing, the isolation kits are not isolating even though isolation kits are installed.

Why would a company decide not to use isolation? Isolation kits typically cost considerably more than standard gaskets, so a company may decide to save money by not utilizing them. Just one instance of a pipeline failure, however, can outweigh the cost of all current and future isolation kits that the company would have purchased. The costs to blow down the line, hire a crew, potential fines, increased reporting and possibly the unearthing of the line far outweigh the costs of properly isolating the pipeline. None-the-less, companies elect to not use isolation or go for extended periods where an isolation joint has failed based on whether the connection falls under jurisdictional coverage or not. Whether there are legal requirements to correct the failure or not, there are other hidden costs that we will discuss later in this paper that can assist in justifying the corrective action necessary to fix the isolating connection.

Isolation kits do not always function properly. Recent interviews with many oil and gas companies have indicated that their isolation products operate between 0% failure up to 50% failure rates. These are multiple types of isolation products and applications. The gasket may be cracked during installation from too much load, flange rotation or point loading, the sleeve may be damaged by the stud threads during a forced installation (typically with flange mis-alignment) or by flange side-loading, the washer set may be installed backwards (a very common mistake) and the isolating washer is cracked due to poor torsional strength or a myriad of other installation issues. The net result is an isolating kit that isn't isolating. The installation crew, due to timeline constraints, may be forced to move on. Unfortunately, it is common that the decision to either leave the isolating gasket in place and not isolate or replace with a non-isolating gasket is made. Another unfortunate situation is when an isolating kit is tested, but not tested properly and the kit isn't isolating, but the test result shows that it is. This is a less common occurrence but occurs when the probes do not penetrate the flange coating and/or the person executing the test has not been properly trained. Another scenario is when an isolating connection isn't isolating even though the kit is functioning as it should. The culprit in this case is usually a metallic by-pass such as a metallic tube carrying data lines, a metallic tube carrying pressurized air for air actuated valves, or pipe supports that are not isolated properly from the piping. Or it could be from conductive media/particles in the pipeline bridging the isolation.

IF THERE IS NO ISOLATION AT THE APPROPRIATE FLANGED AREAS, THE FOLLOWING CAN OCCUR:

01 Increased electrical costs
02 Increased likelihood of hydrogen induced corrosion
03 Potential for electrically induced coating disbondment
04 Increased potential for stress corrosion cracking
05 Greater potential for current to stray to and from pipeline
06 Potential for unsafe electrical exposure for personnel

Proper isolation of a steel structure is essential to managing the cost of operating an impressed current cathodic protection (ICCP) system for any given asset. When determining what the cost of powering an ICCP system should be there are two key variables to consider, and they are as follows:

#1 ICCP systems require a voltage output that is determined by the size of the steel structure that needs to be protected. The larger the continuous structure, the higher voltage output you will need. This is especially important to consider when the structure is in close proximity to other structures such as crowded right of ways. Unprotected structures in close proximity to the structure you intend to protect will need to factored into your CP output requirements.

#2 The cost of fuel to supply enough power to the ICCP system so that the proper voltage output can be achieved (cost of fuel varies by geography).

Consider the example in the graphic below. This example is a 10 mile stretch of carbon steel pipeline that lays out the cost of operating the ICCP system with isolation products used properly (blue) and without any isolation at all (green).

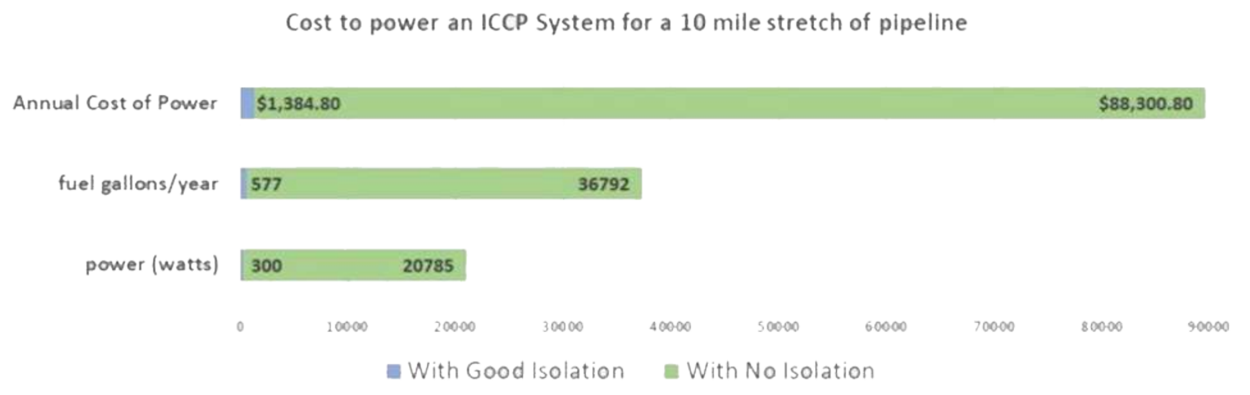


Figure 1:
COST TO POWER AN IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM (1)

The reasons why the cost is so different with isolation is for the following reasons:

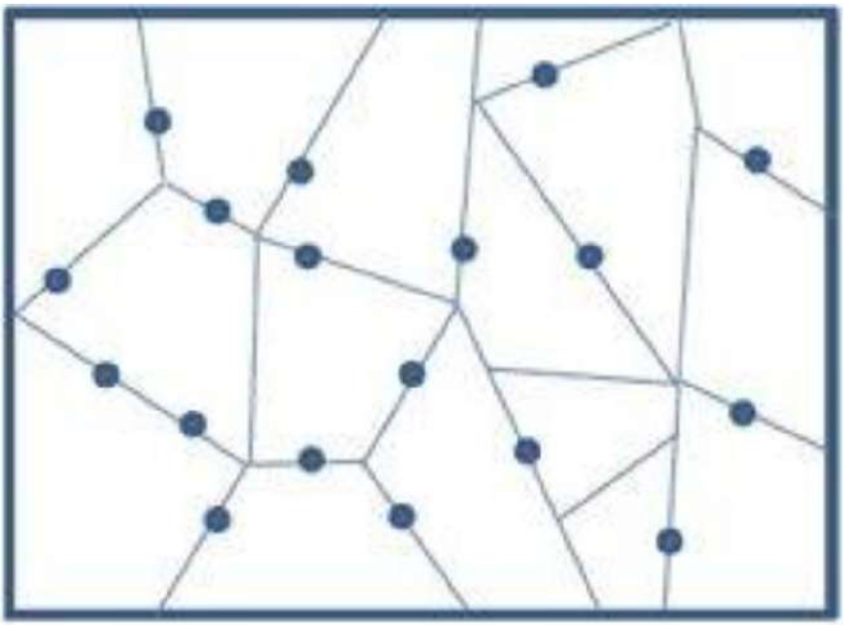
Isolated Segments contain problems that can drive the voltage requirement up

Isolated segments take less power and therefore less fuel to generate the necessary voltage output to achieve proper CP

These costs can vary greatly as you can see in the table above. With properly coated and effectively isolated pipeline you can keep the cost of CP to a minimum. However, 20% to 50% of isolation connections are currently in an unintentional, non-isolated state at any given time. Consider reviewing the amount you are spending on power for the ICCP system associated with your pipeline and see where you fall in the range above. This will give you a quick reference to determine if you could benefit from improving your pipelines isolation.

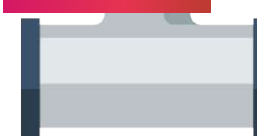
While increased electrical costs can hurt your bottom line, there are far worse issues that can result from improper isolation that pipeline owner/operators are faced with. The process of hydrogen induced corrosion is one of them and it can lead to symptoms such as hydrogen blistering and or hydrogen cracking in the walls of carbon steel pipelines. The voltage and current generated by a CP system are generally very low (15V, 15mA or less). Isolation provides a necessary segmentation of the pipeline which allows for low voltage and low amperage requirements to maintain sufficient CP. If the voltage and amperage requirement increase due to poor or no isolation, the rate of water molecules breaking down increases. This process, known as electrolysis, is how electricity traveling through water breaks down the H2O molecules. As that rate increases, the presence of hydrogen gas atoms naturally increases as well. Hydrogen atoms want to join back together to make H2 through an ionic or electrovalent bond. When hydrogen ions and anions join back together, they react off each other and expand to larger than their individual size. This results in hydrogen gas bubbles forming within the wall of the pipe. The stress caused by this process is enough to create blistering and cracking in the wall of the pipeline and can lead to catastrophic failures. This process, known as hydrogen induced corrosion, is a well-known form of corrosion that is affecting pipeline integrity across the world.

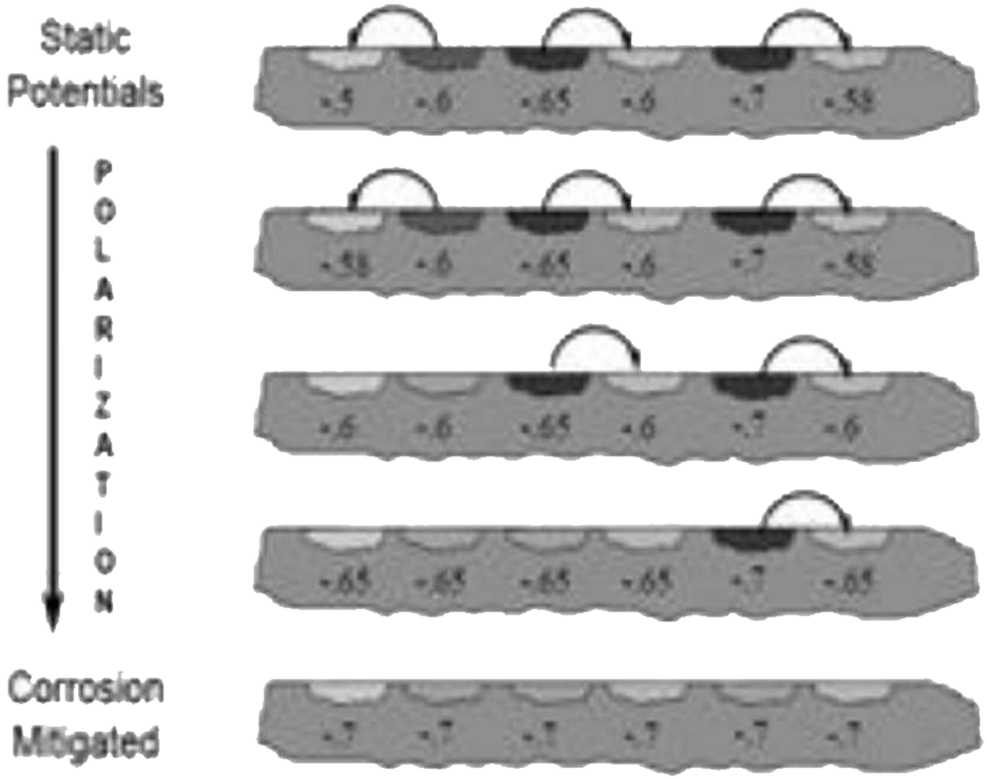
With the proper use of isolation in pipeline CP systems, the required voltage output of an ICCP can be reduced and therefore reduce the likelihood and/or rate at which the electrolysis chemical reaction takes place within the pipeline. Electrolysis is the first step in the process of HIC or hydrogen induced corrosion. Therefore, by maintaining proper isolation, the rate of electrolysis is slower and as a result reduces the risk of hydrogen induced corrosion in carbon steel pipelines.



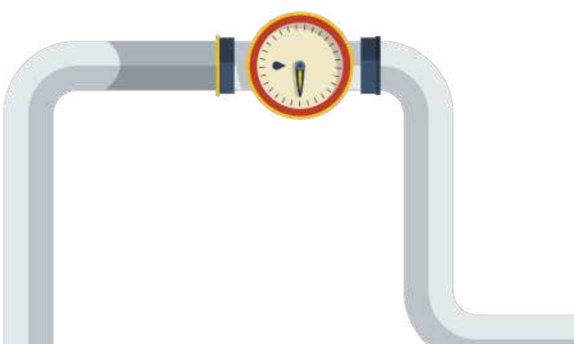
COATING DISBONDMENT PROCESS

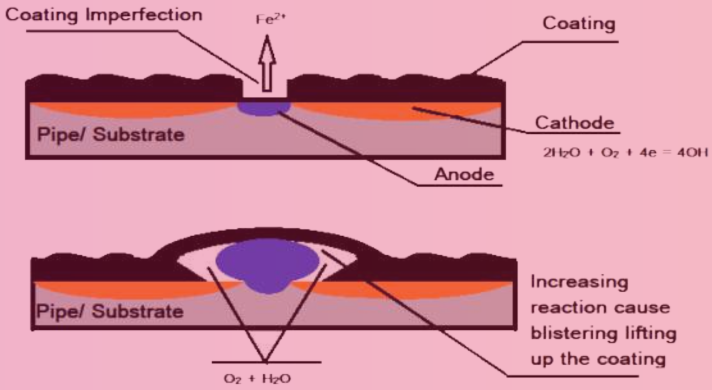
LOSS OF ISOLATION — INCREASE IN CP — HYDROXYL GROUP FORMATION — INCREASE IN CREVICE pH — ADHESION LOSS/DISBONDMENT



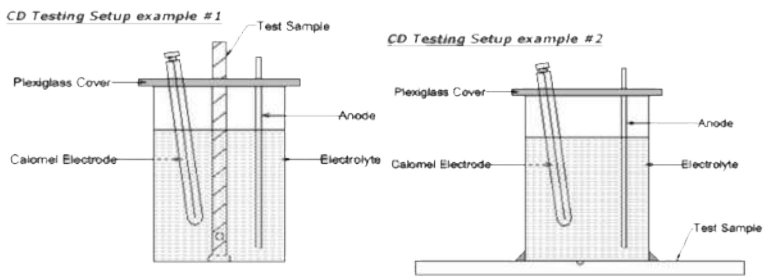


Corrosion under coating disbondment is an undesirable phenomenon which is difficult to detect using conventional above ground techniques. Due to the presence of electric current in a CP system, if a coating is not stable in the CP environment, a highly alkaline environment coupled with the polarized potential can cause coating to lose adhesion and dis-bond from the substrate. Coating disbondment occurs when all adhesive forces have been lost locally. It is recognized that the adhesion property of a coating is a key determinant in the long-term ability of a coating to protect the substrate. The presence of a small pinhole can lead to cathodic reaction at the holiday in the coating which then stresses the disbondment of coating from around the edges of the holiday. The mechanism of cathodic disbonding is a debated subject but it is generally agreed that the cathodic reaction at the holiday site in the tested coating forms an alkaline (high pH) water film under the coating that causes the disbonding. The amount of such a corrosion is determined by the amount of current available and the size of the coating defect. Also there seems to be some connection to the fact that adhesion between the coating and the steel surface is affected by the high pH factor evolving due to the CP on areas where bare steel is exposed to such electrolyte. Studies have revealed that in the presence of CP, the pH inside a crevice increases with time. If enough time is allowed, the pH factor in the crevice become higher than a holiday. Likewise, an O2 (g) concentration cell can form in the crevice, which in turn determines corrosion rates. The ionic current generated by the differential O2(g) content along the crevice results in a deeper penetration and, therefore, in a more severe corrosion activity.





As the defect gets larger, the current flow increases and more of the coating is pushed away from the metal. Both oxygen reduction and hydrogen evolution are possible cathodic reactions that will increase the pH at the cathode. This can result in rapid disbondment and coating breakdown. Several more factors such as concentration of stray current, ground water chemistry, CP level, oil chemistry, surface roughness, surface contamination, pipe bending, and the presence of defects can significantly affect adhesion.



There are cathodic disbonding test methods to determine the resistance to cathodic disbonding of a coating system between coating and steel substrate, resulting in a loss of coating adhesion. Two typical test setups for Cathodic disbondment is shown in the figure above.

So, the reaction that causes the disbondment can be summarized as-

01 Formation of hydrogen gas bubbles near/under the edge of the coating causing lifting of the coating
02 And formation of hydroxyl-ions causes leaching of the coating and/or adhesive of the coating, thereby changing properties of the coating that are essential for proper adhesion to steel.

Flange isolation kits and isolation joints are means of preventing electrochemical reactions from occurring between two dissimilar metals by breaking the metallic path or preventing the current in a cathodic protection (CP) system from traveling beyond the area intended to be protected by the CP system. Even unintended stray currents will be kept away from affecting an unprotected pipe. Proper isolation joints at regular intervals helps to localize and contain the spread of a defective area from propagating further on the pipe. Hence it is highly recommended to isolate the structures / pipes adjacent to a CP system and have isolation joints working properly at critical intervals to minimize damage by disengaging the area that needs rectification in the event of coating failure.

Stress Corrosion Cracking

It is surprising to many, but isolation kits can also prevent flange and weld corrosion damage in RTJ to RTJ or RTJ to raised face flange connections. Those companies that opt out of using isolation kits run the risk of flange and/or weld damage. The flange and weld damage often presents itself through Stress Corrosion Cracking (SCC).

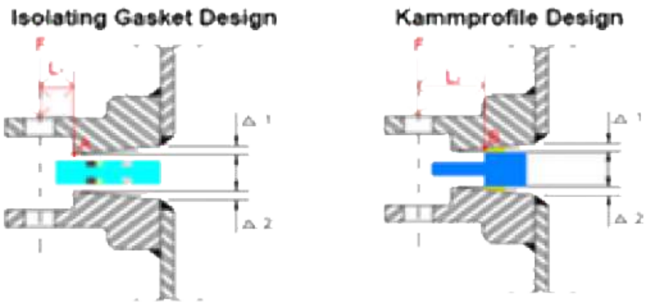
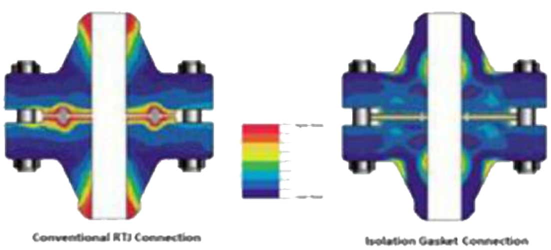


Figure 6: Moment Arm

The moment arm of a typical isolation kit is very short. The length of the moment arm during installation is simply the contact point of the outside diameter of the isolation gasket to the centerline of the bolt (see figure 6). The moment arm length of other non-isolating gaskets is often much longer. If we examine a typical Kammprofile gasket, for example, the moment arm is from the contact point of the diameter of the seal to the centerline of the bolt. To put this in perspective, a typical high-pressure isolation kit will generate approximately 100,000 psi Von Mises stress whereas a Kammprofile of the same size and pressure class will generate approximately 250,000 psi Von Mises stress. An Finite element analysis (FEA) analysis shows the effects of these higher stresses on a flange (Figure 7).



In this case an RTJ flange with an RTJ ring is compared to a high-pressure isolation gasket in a raised face flange. It is quickly ascertained that the stresses are concentrated at the RTJ flange face and the weld neck area. These two areas are then the most likely geographies for stress corrosion cracking. Surprisingly, isolating gaskets can be used in RTJ flanges and significantly extend the life of the RTJ flange. Not only through lower flange stresses, but isolation kits are typically manufactured to the exact flange bore which will reduce flange face corrosion and erosion.

Greater potential for current to stray to and from pipeline

Stray current corrosion is when direct current enters an underground metallic object at one point (the cathode) only to return to the electrolyte at another point (the anode). This state can be in flux depending on the activities in relationship to the pipeline. A DC powered light rail may pass by occasionally, a welder may introduce current into the ground on an infrequent basis, etc. Although the cathodic section of the underground metallic object has some amount of protection from the aforementioned anomalies, due to the stray current, damage occurs at the anode as the current returns to the electrolyte in proportion to the rate of current discharge. Impressed current cathodic protection systems, due to their large area of protection and higher voltage, are more likely to influence other buried metallic structures than are passive sacrificial anode protection systems.

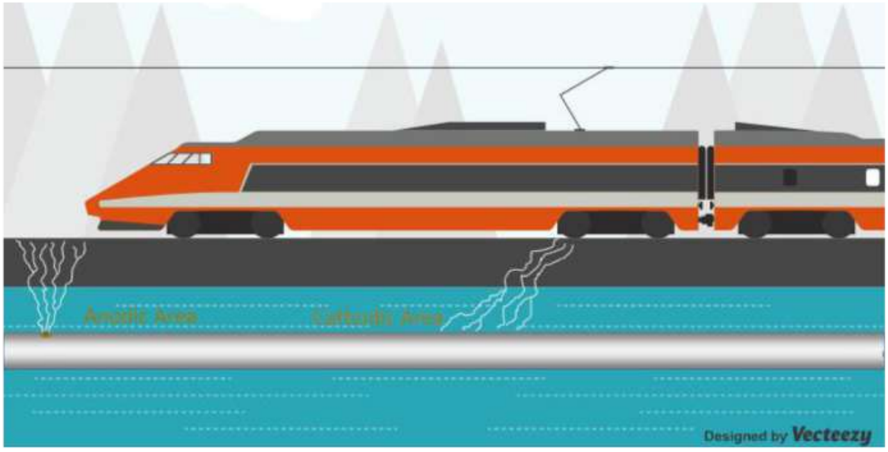
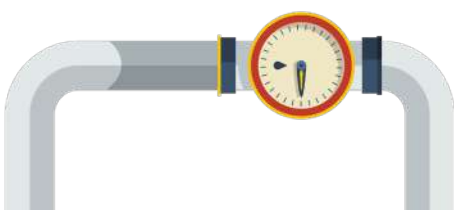


Figure 8: Stray current

Change pipeline A/B to intended target/unintended target

As can be seen in the above diagram (Figure 8), if an underground metallic structure ("Pipeline B") is within an area of influence, corrosion is likely to occur. As the stray current passes through the electrolyte and through the pipeline at a cathodic site, the change in potential along the structure creates the conditions necessary to form a corrosion cell with the current exiting the pipeline at an anodic site. The departure site will be an area of potential corrosion. The metallic structure can be buried or immersed and is susceptible to stray current corrosion. DC railways, tunnels, underground pipelines, and storage tanks without CP systems are particularly susceptible to stray current corrosion. Stray current corrosion is not strictly isolated to DC current. AC stray current can cause corrosion on a buried or immersed pipeline and can also cause corrosion on the metallic surface where coating holidays exist. Corrosion damage is directly related to A.C. current density, level of D.C. polarization, holiday multitude and magnitude and soil resistivity. AC interference and corrosion can be caused by virtually all forms of coupling with AC power systems (2).



The greater the difference in potential, the greater the current flow and unfortunately greater corrosion effects. If combined with low resistance soil, high currents can be produced, with proportionally high rates of corrosion. The stray current corrosion only occurs at the point of exit (anode site) on the pipeline. As a matter of fact, the stray current provides some level of protection to the cathodic entry point and points along the pipeline between the cathodic and anodic sites. Stray current corrosion will be concentrated at the location that leads to the lowest electrical resistance in the current circuit. Environmental factors such as oxygen concentration, chlorides, and pH that are so critical to natural corrosion processes are no longer relevant. Stray current corrosion is fundamentally different from other (non-stray current) types of corrosion in that stray current corrosion is an electrolysis process. In the electrolysis process, the external current (stray current) alone drives metal atoms into electrolyte as water-soluble ions.

Figure 9: Stray current damage

Once an isolating kit or isolating joint is found to not isolate, but left in service, the isolating kit will then allow stray currents to potentially affect the pipeline. As can be seen in image in Figure 9, the electricity exiting the pipeline can cause significant damage to the anodic area of the pipe (3).

How do operators protect against corrosion from stray currents? Protection can be achieved against the corrosive effects of stray current by either negating the stray current through isolation or by collecting the stray current via know paths. This is often referred to as "stray current control".

The quality of each isolation kit or joint should be validated before installation and tested at least as frequently as the law allows. A loss of isolation or lack of use of isolation may result in potential corrosion problems. The resistance of underground metallic pipelines can be tremendously increased by using short segments of pipe with isolation kits or joints. By increasing the resistance of the pipeline, it makes it difficult for electricity to travel along the structure (4).

The use of isolation is more than good, common sense. It is often required by law. PHMSA (Pipeline and Hazardous Materials Safety Administration) states that each operator must minimize the effects of stray currents on its pipeline and minimize the effects of stray currents from its cathodic protection system on existing adjacent underground metallic structures (2). If stray current from a pipeline cathodic protection system is causing damage to another underground metallic pipeline system or structure (owned by the same operator or others), the operator must minimize the detrimental effects of such currents. In addition, there may be other legal responsibility for damage done by rectifiers(5).

In the design stage, it is critical to evaluate potential stray current parallel paths or sources and eliminate them as early as possible through isolation or a collection or shielding design. If unable to isolate, collect or protect, the only remaining option is to utilize a cathodic protection system to offset currents attacking a structure.

Safety concerns for high voltage CP systems with no isolation

In the case of Impressed Current Cathodic Protection (ICCP), the power supply may be required to cover large distances and therefore also require large voltages such as 50 V DC at high currents of 50 A DC. This power may "leak" to the surface pipes and could create sources of ignition in the form of arcs or even hot surfaces in hazardous areas.

An arc is the creation of "a luminous electrical discharge between two electrodes or other points" and is the same as on an electrical arc welder.

Current in pipes - Pipes, etc. are not explosion protected but do transport the flammable product. In general, the subsurface pipes are protected by CP. In some cases, this CP current "escapes" through, for example, pipe clamps fitted below the isolation flange or pipes earthed at the wrong point.

A good example of the danger is the splitting or opening of an aboveground pipeline by splitting the two flanges. The scenario may be described as follows: A pipeline is used to transport fuel and needs to be changed or repaired. The product is drained, and the line is flushed. There remain fuel vapors in the line. The maintenance personnel do not expect any CP currents to flow in the above surface pipes or the person may be working on an underground pipe to repair a leak. An ICCP system may have an open circuit voltage of 50 V DC and a 50 A current capability. The electrical conditions are more than enough to draw and maintain an arc. The mechanical person removes the bolts and pulls apart the flanges. A high energy arc is created between the flanges that may ignite the escaping vapor and could flash back into the pipe. If the ignition flashes back into the pipe you have confinement of the fire that could create a high-pressure wave front at the opening between the flanges. This pressure front could create physical damage. The flame front could create fire damage.

Deep well ground bed

The solution is to shut down and isolate all CP systems **in the area. Alternatively, the flanges may be shorted** out and kept at the same potential by the shorting cable.

Motor and pump bearings

In the case where pumps and pipes are connected to storage tanks, several design principles are to be followed. When using a local CP system the tank is connected to the local CP system and isolation flanges are used to disconnect the CP system from the earth and also to disconnect the anode (the tank) from the rest of the pipes.

The isolation flange is placed between the tank and the pump intake. If this isolation flange is not placed correctly a DC current flows from the CP system to the tank through the flange to the pump. The pump is connected to the motor through the coupling and the motor is earthed to the plant or substation earth. The DC current from the CP therefore flows through the bearings of the pump or motor to earth, depending on the lowest resistance path. The bearings on the motor may then create arcs and even a hot surface. The bearings are destroyed by the arcs and will only last a short period.

The current depends on the rating of the transformer rectifier unit (TRU) and the constraints in the circuit. The circuit may therefore carry 50 Amp and it is possible to weld metal to metal at this current. The type of current may be identified by using a full frequency range current measuring instrument in the form of a clamp meter. The meter should be able to measure ampere in direct current in this case. The current will most probably be flowing in the motor or pump earthing cables.

Enforcement Guidance CORROSION Part 192 Revision Date 12/7/2015 Code Section §192.463(c) Section Title External corrosion control: Cathodic protection. Existing Code Language The amount of cathodic protection must be controlled so as not to damage the protective coating or the pipe (5).

The current flow resulting from CP is designed and intended to protect the metal pipe or vessel. Under some conditions of poor maintenance, soil conditions, and proximity of other metal structures, the current does not flow on the preferred path. From the above examples and discussions, we can see that a poorly planned or maintained CP system can be more detrimental than providing protection to the systems. The results on surrounding structures can be very dramatic. A wrongly designed and installed CP system can lead to stray currents and accelerating corrosion in other unprotected structures/ pipelines as well as a safety hazard to nearby humans. Electrical shock and corrosion are just two of the observed effects. NACE in SP0177-2007(6) states that a voltage of over 15 volts AC is detrimental to human life.

There was a study on a system of pipelines in a region within the vicinity of few meters from a neighborhood, where few of them had been with CP system and couple of them without CP protection. In the entire operation of those lines for about a year, lot of unwanted effects were seen in the nearby structures and residential electrical equipment and parameters. Several underground tubing especially the copper ones ended up corroded or eaten up. Several electrical equipment along with motors ended up broken.

Finally, when rectification works were carried out it was zeroed down to a failed CP system causing the corrosion problems to the plumbing and electrical ground circuits in the area. Once the facility ground was corroded, a scenario was set up for stray currents. The system did not have adequate ground protection to keep the stray potential from seeking alternate paths. Without adequate grounding, the electric current sought the lowest resistance route. This was through the metal in the pipeline. This graphically emphasizes the need for proper system isolation and maintenance.

As seen above improper design and installation of CP system along with Rectifier malfunctioning can lead to damage of adjacent structure and electrocution of humans. Also unprotected pipelines in the vicinity of a CP protected system without proper isolation and grounding can also lead to electric shock hazard of not only personnel working with these systems, but also with residents who live in the vicinity are endangered. As observed earlier, the drop of sufficient voltage over the entire run of the pipelines is compensated by additional power supply, this may lead to exposure of unintended structures and life to current values much higher than safe limits. There was a study on a system of pipelines in a region within the vicinity of few meters from a neighborhood, where few of them had been with CP system and couple of them without CP protection. In the entire operation of those lines for about a year, lot of unwanted effects were seen in the nearby structures and residential electrical equipment and parameters. Several underground tubing especially the copper ones ended up corroded or eaten up. Several electrical equipment along with motors ended up broken.

As seen above improper design and installation of CP system along with Rectifier malfunctioning can lead to damage of adjacent structure and electrocution of humans. Also unprotected pipelines in the vicinity of a CP protected system without proper isolation and grounding can also lead to electric shock hazard of personnel.

To understand the effectiveness of Isolation in a pipeline, the following considerations will be critical. Before we conclude this discussion, it makes sense to revisit the six different causes for failure in a pipeline and line them vis-a-vis with the solutions that can be found by just Isolating the line properly.

CAUSE	IMPACT
Increased electrical costs.	Decreased electrical costs due to break down of large continuous protected structures and proper separation of unprotected lines from protected ones
Increased likelihood of hydrogen induced corrosion.	Decreased likelihood of hydrogen induced corrosion due to
Potential for electrically induced coating disbondment	Mitigate potential for electrically induced coating disbondmentby reducing the propagation of coating failure under CP systems
Increased potential for stress corrosion cracking	Decreased potential for stress corrosion cracking
Greater potential for current to stray to and from pipeline	Mitigate potential for current to stray to/from pipeline to unintended targets
Potential for unsafe electrical exposure for personnel	Mitigate potential for unsafe electrical values for personnel

Now that leads to the question where exactly you need Isolation in pipelines to achieve the desired results in safety and optimization of CP systems used. The authors have outlined a general guideline below to where electrical isolation may be required and the typical isolation methodologies available:

01 AT THE EXTENT OF THE PROTECTED SECTION OF A PIPELINE

02 AT ALL OFF-TAKES TO PIPELINES WHICH ARE NOT INTENDED TO BE PROTECTED BY THE PIPELINE CP

03 AT SCOURS WITH METALLIC SPOOLS

04 AT METERED OFF-TAKES WHERE THE OFFTAKE IS METALLIC

05 MOTORIZED VALVES WHERE THE MOTOR IS BONDED TO ELECTRICAL EARTH.

06 AT PUMPS. INSTALL INSULATING FITTINGS ON BOTH SIDES OF THE PUMP

07 MAG FLOW METERS ARE NORMALLY BONDED TO ELECTRICALLY EARTH. PROVIDE INSULATING FLANGES ON BOTH SIDES OF THE METER

Finally, the reasons why an isolating kit may not be isolating could be the topic for another paper. However, to simplify, isolation kits typically do not isolate due to one of these three causes 1) poor installation 2) sleeve damage 3) conductive media.

We understand that it is not always financially feasible to replace an isolating kit upon determining that it is not isolating. However, we wanted to give all readers of this paper the information necessary to make an educated decision as to whether the isolation kit should be repaired or replace or not prior to making that decision and all the ramifications that could be endured should the pipeline be operated with a non-functioning isolation kit. If an isolation kit is not isolating for any of the three reasons above, it may be solved by simply reinstalling a kit with the proper installation procedures, replacing the damaged sleeve or by using an isolating gasket with a PTFE or restructured PTFE inside diameter seal. If proper steps are taken during the installation process, the kit should be electrically tested prior to fully torquing the bolts. If the kit is found to not be isolating a replacement kit can be installed before too much time and effort is invested in the non-isolating kit.