# Section 11:
# ZEVAC® for Valve Replacement

## Problem Description

As a pipeline ages, its valves can begin to degrade due to a variety of reasons. Eventually, a valve can fail and prevent gas from efficiently passing through, or preventing proper shutoff, essentially putting the entire line out of service.

A valve replacement is required before the pipeline can be placed back into service, which means that the line itself must be depressurized. Traditionally, the section of the pipe where the valve is located is isolated, and the remaining gas within is vented into the surrounding area. Depending on the size of the pipe and the pressure at which the gas is maintained, this process can vary in the time it takes to complete and may not even reduce pressure to a desired level. This process also leads to a complete loss of product, which can be financially unattractive for the operator.

The innovative solution of ZEVAC offers a different approach. The gas within the isolated section of pipe can be transferred from the isolated pipeline back into the live section of pipeline, eliminating the loss of gas to the environment due to venting, reducing emissions overall. As valve replacements can occur at any point along the pipeline, there are times when a replacement is required within a more heavily populated area. It would be preferable to reduce any release of natural gas and keep any service downtime to a minimum. Since ZEVAC can reduce drawdown time while also eliminating the need for venting, it can be seen as the more favorable alternative, but there are several considerations one must take before using its system.

Before implementing ZEVAC, careful considerations must be made. Factors such as pipeline size, gas pressure, and infrastructure compatibility should be assessed. Safety measures and protocols should also be established to ensure the effective and secure operation of ZEVAC. By leveraging ZEVAC's capabilities, valve replacements can be conducted more efficiently and with reduced environmental impact, leading to improved pipeline operations.

# Illustrated Checklist and Diagram – Portable Install

Prior to ZEVAC use, it is essential to identify the procedural steps needed to take place to have an successful valve replacement. The major procedural steps for a valve replacement include:

1. Recognizing and understanding Maximum Allowable Operating Pressure (MAOP) of pipeline and flow of gas. Example: Looped systems or dead-end systems.
2. Identification of isolation valves for intake and discharge points.
3. Utilize stopple or close valves to stop the flow into the portion of the pipe to be depressurized.
4. Connect the ZEVAC unit to the installed taps using flex hoses and appropriate fittings. Then, connect the ZEVAC unit to the air compressor with the air hose. Ensure the whip checks are in place and open the tap valves. Purge air from the ZEVAC hoses and equipment before starting actual recompression.

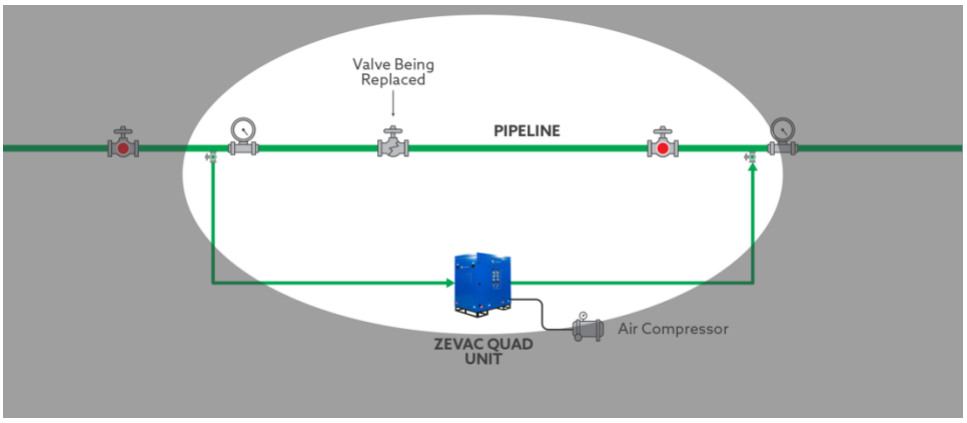


***Figure 59:*** *Diagram of valve replacement (Image 1 of 4)*

5. Record starting pressure of both the discharge portion of the pipe and the intake segment.
6. Turn on the ZEVAC unit. Then turn on the air compressor to begin drawdown.
7. Monitor pressure at the discharge point and intake section to ensure that discharge does not cause over-pressurization of the discharge side pipe system and that intake does not go below desired pressure. Note: The Under Pressure Cut Off Switch (UPCO) and Over Pressure Cut Off Switch (OPCO) are designed to ensure the unit shuts off before reaching MAOP or desired draw down pressure.

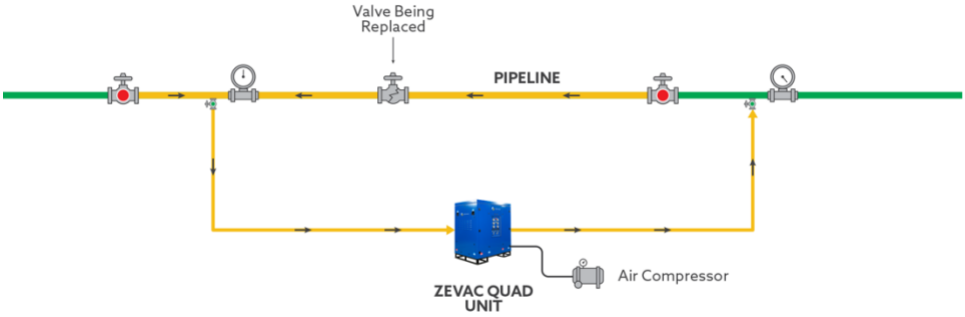


***Figure 60**: Diagram of valve replacement (Image 2 of 4)*

8. Once the desired pressure is reached, stop the ZEVAC equipment and the air compressor.
9. Record the final pressure readings in the intake section and discharge section of the pipe.

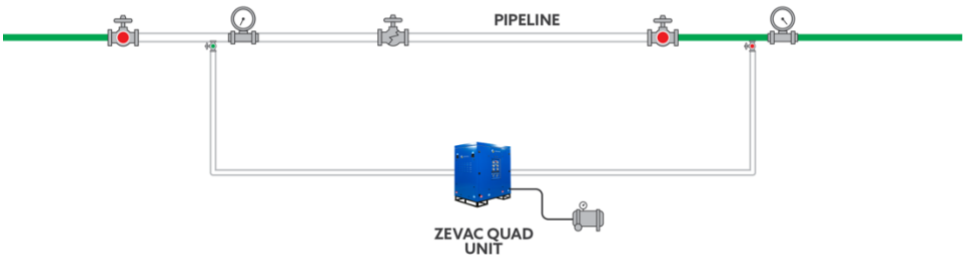


***Figure 61:** Diagram of valve replacement (Image 3 of 4)*

11. Close tap valves and disconnect ZEVAC and air compressor equipment.
12. Proceed with valve replacement.

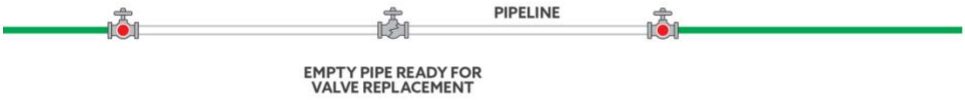


***Figure 62:** Diagram of valve replacement (Image 4 of 4)*

# Case Study: Valve Replacement

| About the Project | |
|---|---|
| **Who** | Xcel Energy |
| **What** | Depressurization of 40 feet of 4.5" steel natural gas main |
| **Why** | Reduce emissions and shorten purge within active construction zone |
| **Where** | Garfield County, CO |
| **When** | July 2022 |


CEPC (Campos EPC) was contracted by Xcel Energy to use ZEVAC to perform the drawdown of 40 feet of 4.5" natural gas pipeline. Since this project was within an active construction zone, reducing or eliminating vented gas was very desirable. Though any gas losses would be minimal, the use of ZEVAC reduced that number to zero while also protecting the surrounding area.

This project, Superior Gross Hahnewald 4.5" Valve Set Blowdown, was the complete depressurization of 40 feet of 4.5" natural gas pipeline to perform a valve replacement. Pressure control fittings were installed on the pipeline upstream and downstream of the valve to be replaced. For this project, a ZEVAC unit was used to drawdown the pipeline from a starting pressure of approximately 359.8 psig to 3 psig in around 3 minutes.

As Xcel had requested the line to be brought to pressure of 0 psig, ZEVAC was used once more for approximately 5 seconds and lowered the pressure to 0 psig. The entire process took about 12 minutes and prevented 96.5 scf of natural gas from being vented into the atmosphere. Upon completion, The ZEVAC unit was disconnected and removed from the line and the valve replacement was able to commence.

Regardless of project size, the prevention of any natural gas from being vented within an active construction zone should be considered a success. The time frame of approximately 12 minutes should be considered beneficial, as it allowed the valve replacement to occur sooner than it would have had the gas been vented.

***Figure 63:*** *ZEVAC equipment setup 1*


***Figure 64:*** *ZEVAC equipment setup 2*

Overall, the use of ZEVAC proved successful in the time it took to depressurize the pipe, the pressure in which the pipe was lowered to (in this case an exact 0 psig), and how much natural gas was prevented from being vented into the atmosphere. While 96.5 scf may seem like a minimal amount of natural gas, if ZEVAC technology is used on more projects, even as small as a valve replacement, the amount of gas saved overall will be monumental and could have a direct impact on the reduction of greenhouse gases being released yearly.

This project was small. Therefore, there are not evident lessons learned that one can point to. ZEVAC executed an efficient job in completely depressurizing the pipe. Similar results can be expected from other projects barring any outside forces, and speaks to the quality of the ZEVAC technology as a whole.

## Considerations

**When setting up a valve replacement project with ZEVAC, there are several items that must be considered:**

- Time
- Labor Costs
- Equipment Rental/Lease/Purchase
- Installing Fittings & Connecting Equipment
- Logistic Constraints
- Introduction of New Technology
- Regulation Changes
- Location
- Pipeline Length & Diameter
- Ease of Use
- Reliability
- Duration
- Clean Up
- Control of Pressure & Volume (Understanding Maximum Allowable Operating Pressure MAOP & Flow of Line)