

Section 2: ZEVAC® for Commissioning New Lines (Ventless Purging)



Project Description

The traditional method of commissioning a new line would be to construct and lay the line where it is set to be installed. This new line will be full of air at atmospheric conditions, which needs to be removed to allow space for the product the pipe will transport. Pressurized gas would then be released into the line creating a gas-air mixture. This gas-air mixture is then vented into the atmosphere at some point further down the line, this process continues until the gas-air mixture being vented contains mostly (or only gas) depending on the system requirements.

While this method is an intuitive and relatively cost-effective way to fill a gas line, this method also has clear drawbacks that can be eliminated with the ZEVAC. This method involves unwanted product loss and methane emissions when the methane gas-air mixture is vented. Additionally, this method is loud and potentially hazardous. After a mixture of flammable gas combines with atmospheric oxygen, the mixture is then forcefully shot into the atmosphere by the pressurized gas behind it.

As stated in PG&E (Pacific Gas & Electricity) standard A-38, Purging Gas Facilities, "Purging can create a significant amount of noise, dust, and odor. Use of noise suppressors, hearing protection, filtration, dust masks, and eye protection may be needed. In addition to notifying applicable state and local noise and air pollution agencies, consideration should be made to notify residents near the venting operations."

Using the ZEVAC, product loss and methane emissions are greatly reduced and often eliminated. Also, using the ZEVAC is much safer when commissioning a new line as there is greatly reduced gas-air mixing as well as venting. Overall, the ZEVAC is a more inconspicuous, safer, and easier option to implement based on location specifics than the traditional method.

Brad Steber, CenterPoint Energy’s Manager of Technical Field Operations for Minnesota, had this to say about their use of the ZEVAC, “A key benefit of vacuum purging is that it helps avoid methane emissions when commissioning a pipeline.” The process also limits nuisance impacts such as noise and odor, in addition to minimizing the safety risk of accidental ignition with a gas-air mixture.”

Illustrated Checklist and Diagram

Prior to using the ZEVAC, it is essential to identify the procedural steps that will need to take place to have impactful commissioning of the new line. The major procedural steps for commissioning a new line include:

1. Identification of intake isolation valve.
2. Identification of location for ZEVAC units and air compressors, ensuring there is sufficient site access to stage and operate all equipment.
3. Connect the ZEVAC unit to an intake point on the pipe using flex hoses and appropriate fittings. Do the same for the air compressor while also ensuring whip checks are in place and open tap valves.

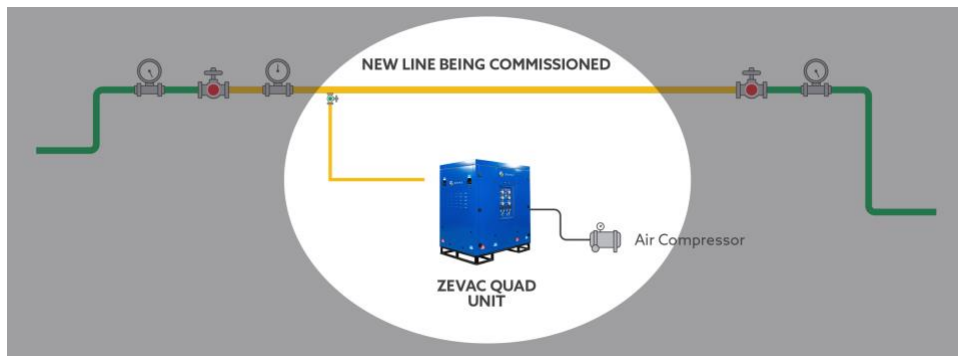


Figure 11: Diagram of commissioning new line (Image 1 of 7)

4. Turn on the ZEVAC unit and the air compressor to begin pumping air out of the pipe.

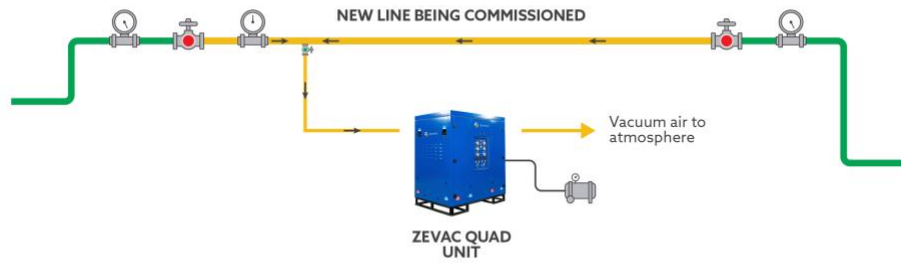


Figure 12: Diagram of commissioning new line (Image 2 of 7)

5. Once desired vacuum pressure is reached, turn off the ZEVAC unit and the air compressor.

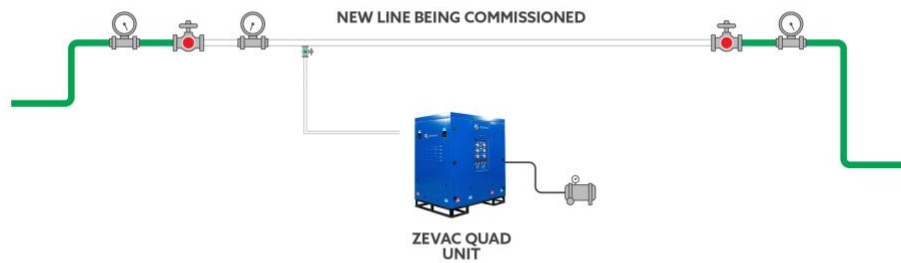


Figure 13: Diagram of commissioning new line (Image 3 of 7)

6. Open the isolation valve to gas-in the new section.

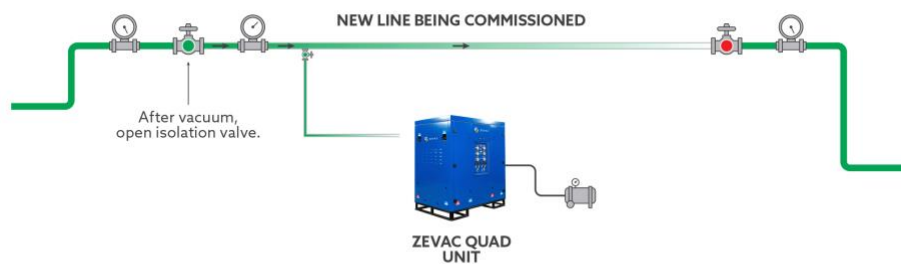


Figure 14: Diagram of commissioning new line (Image 4 of 7)

7. Monitor the vacuum gauge as the gas fills the pipe back to line pressure.

- 8. Record final pressure reading in new line.

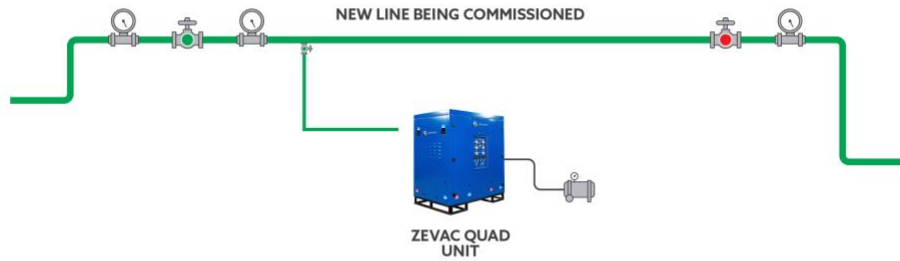


Figure 15: Diagram of commissioning new line (Image 5 of 7)

- 9. With a Combustible Gas Indicator check all purge points.
- 10. Verify desired percentage of gas at all purge points.



Figure 16: Diagram of commissioning new line (Image 6 of 7)

- 11. Disconnect ZEVAC from pipeline and air compressor.



Figure 17: Diagram of commissioning new line (Image 7 of 7)

Case Study: Commissioning New Lines

About the Project	
Who	CenterPoint Energy
What	Fill 3200' of 6" polyethylene pipe with natural gas
Why	Reduce emissions and shorten venting in trafficked area
Where	St. Michael, Minnesota
When	September 2020



ZEVAC was contracted by CenterPoint Energy to commission a new 3200' long, 6" diameter polyethylene line. This would be performed by a ZEVAC operator using the ZEVAC Twin HP and the ZEVAC Quad. Prior to commissioning the line, the line was pressure tested using air as the test medium to ensure the strength and integrity of the line.

After connecting the two ZEVAC units appropriately to the extraction point and air compressors, the extraction began and ran for approximately one hour and achieved a final vacuum pressure of -13.8 psi. This correlates with approximately 94% gas purity in the line using the vacuum pressure vs psi chart. This was deemed sufficient gas purity for the line, at which point the ZEVAC units and air compressor were turned off, and the point of connections were closed.

Once this had been performed, the new line was free to be pressurized by opening an inlet valve. The new gas was then suctioned into the line by the vacuum created by the ZEVAC. Overall, this project was a resounding success, and the new line was connected to the distribution system without issues.



Figure 18: Equipment setup at site



Figure 19: Pressure monitoring tree installed on pipeline

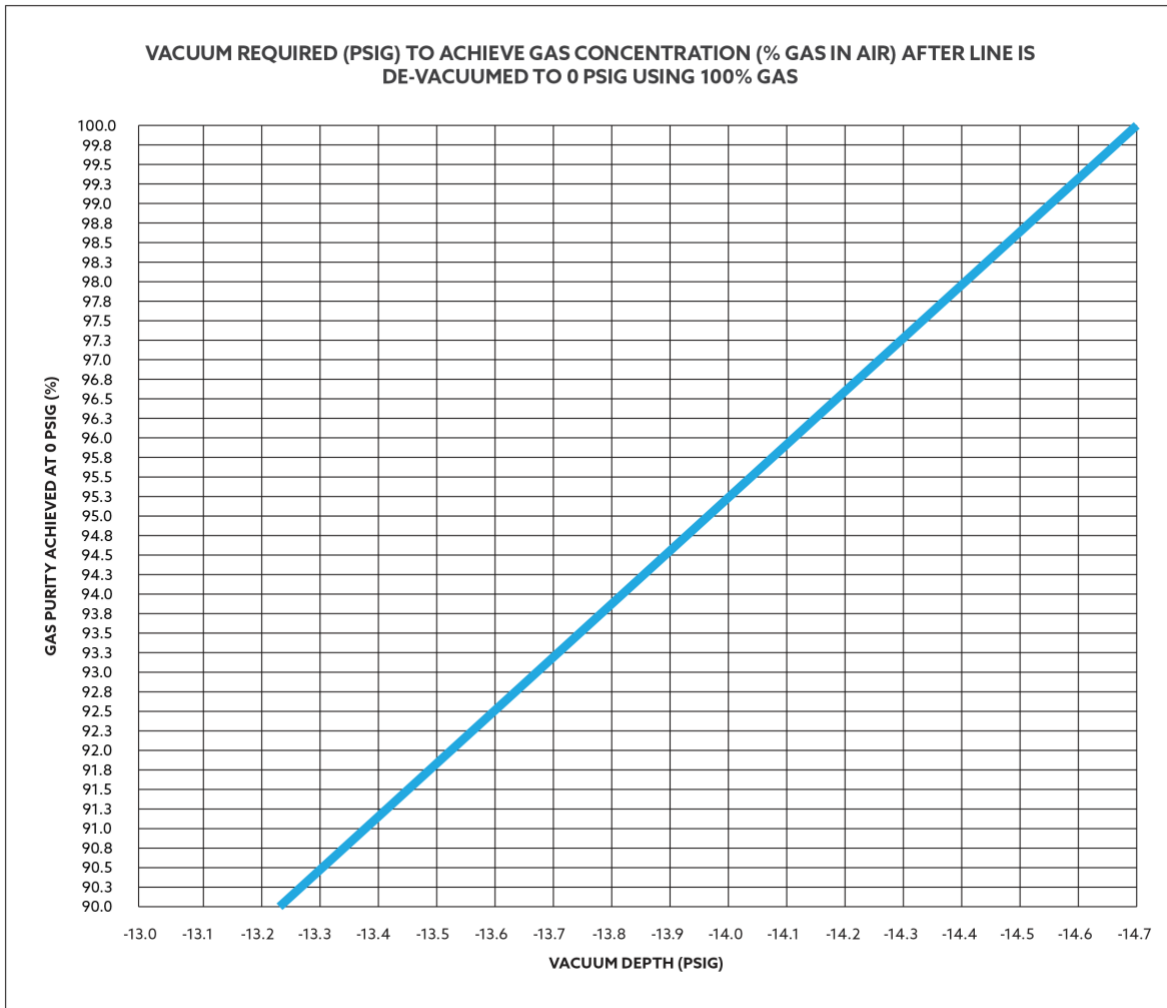


Figure 20: Vacuum pressure vs gas purity percentage of gas-air mixture

Results, Conclusions, and Lessons Learned

In the case study examined, venting was eliminated completely, making this project a huge success. However, there is one notable difference to using the ZEVAC as opposed to the typical venting method. According to PG&E purge calculation data sheet, a purge for a pipe of this size would have taken approximately 12 minutes, as opposed to the hour-long vacuum drawdown and the additional minutes for the gas to fill the line once the vacuum had been created.

However, the benefits of avoiding venting will always be significant. Venting an odorized gas-air mixture will almost always be a very loud and conspicuous event and, depending on the environment, isn't a viable option in many instances. ZEVAC's method of commissioning a new line avoids these problems and provides a solution that greatly reduces risk, emissions, and public nuisances. When vacuum purging a line, the process is much more controlled and safer relative to the traditional method where methane-air mixture is vented to the atmosphere at high pressure.

Considerations

When commissioning a new line project using the ZEVAC, there are several considerations to make:

- Identify suitable extraction point.
- Connect the ZEVAC to intake air from new main and discharge into the atmosphere.
- Proceed with final commissioning procedure once sufficient vacuum is reached inside the pipe.

Additional steps that may aide in project planning and execution include:

- Determining pressure and system volumes so proper calculations can be made, and correct equipment can be specified.
- Conduct work during non-peak flow timeframes.
- Identify additional locations where the ZEVAC may be hooked up and use multiple units along pipeline section or in series/parallel to minimize extraction times.

Challenges to consider prior to mobilizing the ZEVAC for vacuuming a system to commission a new line are:

- Labor costs
- Equipment rental/lease/purchase
- Installing fittings to connect equipment
- Logistic constraints
- Introduction of new technology
- Regulation changes
- Location
- Pipeline length and diameter
- Ease of use
- Reliability
- Duration
- Clean up
- Control of pressure & volume

While each of these challenges requires individual consideration, utilizing the ZEVAC has been proven to minimize the quantity and extent of these challenges. When the ZEVAC is used as a proper solution to venting and flaring, many of these challenges are reduced to small concerns.