Pressure Testing SAFETY:

Tips for Secure Pneumatic Gas Processes

Understanding the Dangers of Pneumatic Pressure Testing

The risk of serious injury and even death is inherent in pressure testing. While all types of pressure testing have significant dangers and require caution, the safety of pneumatic testing has traditionally received a lot of attention. Because of the greater potential energy that is stored during the gas compression process, pneumatic testing is potentially more dangerous than other types of pressure tests. Having a thorough understanding of the associated risks and instructing employees on proper procedures minimizes the possibility of dangerous mistakes and fatal outcomes.

eBOOK

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Recognizing the Risks: Preventing Hazards in Pneumatic Pressure Testing

The potential risks of pneumatic pressure testing can be life-threatening, but understanding and awareness can help mitigate these risks. Complacency during routine tests, failing to follow safety protocols and underestimating risks all contribute to the danger of pressure testing. Providing your staff with ongoing awareness training and safety procedures is key to avoiding critical mistakes and hazardous outcomes.

Because of the higher level of potential energy stored during gas compression, pneumatic tests can be more dangerous than hydrostatic tests. Ensuring that the system is suitable for pneumatic testing can minimize the chance of brittle failure during testing.

Dangers in pneumatic pressure testing usually occur when a material failure causes an explosive release of stored energy, sometimes carrying material as projectiles.

Be aware of:

- A rupture of the assembly while employees are in the danger zone (the area in close proximity to the pressure test).
- Failure of a fitting or component forming part of the assembly, which could be ejected under force as a projectile.
- Detachment of a test hose, striking people within the danger zone as it becomes a dangerous whip.
- Sudden explosive release of gas causing injury to eyes, ears or body.
- Enclosed areas containing gas being asphyxiation hazards.

Injuries due to these situations include:

- Slip and fall injuries.
- Injuries from exposure to explosive force.
- Penetrating injuries from flying projectiles.
- Asphyxiation.
- Loss of limbs or even loss of life.

Reducing Pneumatic Pressure Testing Dangers

Given the serious inherent dangers in pressure testing, facility operators and managers must take appropriate steps to prevent harmful events. Based on the HSE's GS4 testing standards, those responsible for testing should take certain precautions.

To ensure safe pressure testing procedures, complete the actions below:

- Know how the item being tested can be safely energized, monitored and vented.
- Understand how the test medium can be discharged without having personnel in the test danger zone.
- Inspect equipment for leaks, remotely if possible and practical. Intervention may be required to check for the origin of a leak. This should be done at a lower pressure and in controlled conditions.
- Use a hierarchy of control measures to reduce risk if intervention during pressure testing requires people to be placed in the danger zone.

When made in conjunction with process protocol changes, modifications to equipment and systems also help reduce pressure testing dangers. To promote higher safety standards, make sure that:

- Products being tested are fully enclosed.
- Operators perform remote operation outside of the test danger zone.
- Anti-whip restraints and other safety devices are used to reduce unintentional pressure release or over-pressurization of equipment.
- Equipment being used during testing is fully maintained.
- Hoses, fittings and connectors are inspected and changed when worn or fatigued through repeated use.

Difficulties with Pneumatic Testing

Pneumatic tests are potentially more dangerous than hydrostatic tests because of the higher level of potential energy stored during compression of the gas. Care must be exercised to minimize the chance of brittle failure during testing by initially assuring the system is suitable for pneumatic testing. Pneumatic tests could be performed only when at least one of the following conditions exists:

- When the system is designed in such a way that it cannot be filled with water.
- When the system is to be used in services where traces of the testing medium cannot be tolerated.

Comparison of Hydrostatic and Pneumatic Testing:

Hydrostatic Testing	Pneumatic Testing
Test pressure is normally 30% higher than the design pressure.	Test pressure is normally 10% higher than the design pressure.
Recommended for high pressure applications.	Recommended only for low pressure applications.
Test media (water) used is not compressible by pressure application.	Test media (air) used is compressible by pressure application.
Energy stored per unit volume of water under test pressure is negligible.	Energy stored per unit volume of compressed air under test pressure is very high.
Needs thorough cleaning after test to eliminate moisture, especially for surfaces that are reactive to moisture / fluids.	Easy to clean after testing.
Pressure relief devices are recommended to control sudden increase in pressure during testing.	Pressure relief devices are necessary during test to ensure over pressurization does not occur.
Chances of equipment / pipe / test apparatus failures are very low.	Chances of equipment / pipe / test apparatus failures are high.
Weight of equipment along with water as test medium is high; special attention should be given to floor and supporting arrangements.	Weight of equipment with air as test medium is comparatively less.
Needs verification and examination of joints and connections before testing.	Needs very careful checking of weld joints thoroughly before testing.
Test media can be reused or transferred to another location after testing.	Test media cannot be reused or transferred to other place after testing.
Skilled and semi-skilled personnel can carry out the test.	Needs involvement of senior experienced staff to monitor the test.
Recommended where large volumes are to be tested at same time (example: pipe lines).	If pipe lines are tested should be done with small segmental lengths at a time.
Damages caused by failures are minor compared to failures in pneumatic testing.	Damages caused by failures in testing are extensive.
Hydrotest is a day to day safe procedure that can be followed in any work site.	Needs special attention and safety precautions.
Pressure changes finite amount by infinitesimal change in volume.	Pressure change proportional to volume change.

A New Approach to Mitigate Pressure Testing Dangers

Haskel has applied many of these safety measures to its design of test systems, including anchoring points for hoses and using only hoses that have anti-whip restraints or can be fitted with whip restraints. In the event of a coupling, fitting or hose failure under pressure, these restraints prevent a hose from injuring someone in the testing danger zone.

Beyond physical restraints, Haskel is building remote capabilities into the testing setup, which removes test operators from the danger zone. Fully enclosed testing units with secured access are also being used to prevent entry into the test area while systems are under pressure.

Haskel has made investments to develop a new high-pressure test facility equipped with an external control console, enabling an extensive range of proof and performance high-pressure tests to be carried out. The control console is also fully interlocked and has oxygen depletion sensors to control any gas leakages. Haskel's dedication to safety is aimed at eradicating hazards such as chemical injection type injuries or lacerations from loose hoses.

David Angus, Haskel's QHSE Manager at the Sunderland test facility, provided his knowledge on high-pressure testing to help author this eBook.

About Haskel

With over 70 years of unrivaled expertise in high-pressure, liquid and gas transfer and pressurization technology, Haskel is the solution provider for applications in aviation, defense and aerospace, oil and gas and other critical industries. Haskel meets complex and critical challenges with innovative solutions that ensure safety, reliability and the highest quality. As the clear market leader in high-pressure pumps, Haskel products are made to fit customer needs and market demands. Whether working in oil and gas, automotive and defense or extracting cannabis oil in the emerging medical market, every Haskel product provides the performance that is expected from a global leader.

For more information about our high-pressure products, contact a Haskel representative today.

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