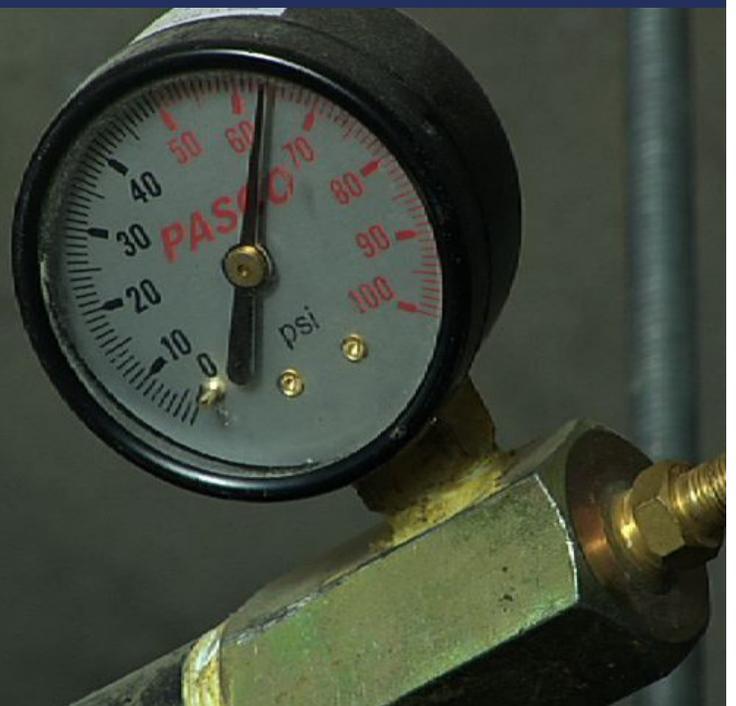


Mechanical Contractors Association

**MCAA**

of America

# GUIDE TO PRESSURE TESTING SAFETY



## Application

This guide applies to the pressure testing of standard metal piping systems, **excluding cast iron systems**. It does not apply to:

- Cast iron piping systems;
- Fiberglass piping systems;
- Plastic piping systems;
- PVC piping systems; or
- CPVC piping systems.

## Forward

MCAA receives frequent requests for information about how to safely perform pressure testing. There are several excellent piping standards that address pressure testing with a liquid under pressure (hydrostatic testing) or air or another inert gas under pressure (pneumatic testing). The standards are published by the American Society of Mechanical Engineers (ASME), and those most frequently used by mechanical construction firms include:

- ASME B31.1 Power Piping
- ASME B31.3 Process Piping
- ASME B31.5 Refrigeration Piping and Heat Transfer Components
- ASME B31.9 Building Services Piping

Pressure testing is a very small part of each of these standards. For example, ASME B31.1 – 2012 Power Piping covers the testing procedures for hydrostatic and pneumatic tests in only two pages. The emphasis is on the process of pressure testing, rather than on pressure testing safety. To bridge the gap, this publication focuses on safe work practices designed to help prevent worker injury during hydrostatic and pneumatic testing of non-cast iron metal piping systems.

## Disclaimer

This guide is intended to provide the user with basic safe work practices for pressure testing standard metal piping systems that are not made of cast iron. It is not intended to provide exhaustive treatment on the subject of metal piping system pressure testing safety, and it should never be used as a substitute for reading and complying with the most current, applicable ASME piping standards and piping system component manufacturers' recommendations/specifications. Further, it is not intended to provide

legal advice. Employers must make independent determinations regarding the need for legal assistance.

## Introduction

Safely pressure testing piping systems can be challenging at times. However, much of the time the procedures are routine and can be accomplished with minimal risk to workers. The keys to safe pressure testing are knowing the potential hazards and understanding how to eliminate them, or at least how to minimize them as much as possible.

**Hydrostatic testing** is the preferred method of testing because it generates considerably less stored energy and thus involves less risk to workers. In this type of testing, a liquid, usually water, is pumped into the system before it is pressurized with air or gas. Water can't be compressed like the air or gas used by itself for pneumatic testing, so considerably less stored energy is generated. While there are still hazards associated with hydrostatic testing, MCAA recommends the use of hydrostatic testing over pneumatic testing whenever possible. At times, hydrostatic testing may not be acceptable for the following reasons:

- The owner requires/specifies that the system be tested pneumatically;
- The building is complete and can't be subjected to the release of a test medium.
- The piping system is designed in such a way that it can't be filled with water or another liquid test medium; and
- The piping system will be used for a specific type of service that can't accept traces of a liquid test medium, such as high purity piping systems for pharmaceuticals or food.

**Pneumatic testing** is more dangerous for workers and should be performed only when hydrostatic testing isn't acceptable for one or more of the reasons above. Pneumatic testing generates potentially dangerous stored energy because the air or gases are easily compressed when used in the systems without liquid. To get a feel for how potentially hazardous pneumatic testing can be, take a look at the following comparisons between the stored energy in piping systems, and the equivalent stored energy in Trinitrotoluene (TNT), an explosive that is the standard measure of strength for bombs.

- 500 feet of one inch pipe at 150 psi is equal to 1.6 ounces of TNT
- 500 feet of two inch pipe at 150 psi is equal to 8 ounces of TNT
- 500 feet of six inch pipe at 150 psi is equal to 5 pounds of TNT

**MCAA recommends the use of pneumatic testing only as a last resort.**

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## Safe Pressure Testing

Most of the hazards associated with pressure testing come from the sudden, unintended release of stored energy. The risk of injury from a failing joint, connection, gauge, valve, fitting or another component increases during the testing process, especially during pneumatic testing. Safe work practices are needed for all types of pressure testing in order to protect the workers performing the tests.

## Pressure Testing Hazards

Pressure testing hazards include:

- Flying objects such as valves, flanges, gauges, and fittings;
- Flying shrapnel such as small pieces of pipe, pipe fittings, or other system components that shatter into parts from the pressure;
- Oxygen displacement from an inert gas used for testing; and
- Flooding in areas where energized electrical sources are present.

## Injuries from Pressure Testing

Most, but not all, injuries from improper pressure testing are inflicted by flying objects. Some of the more obvious pressure testing injuries include:

- Puncture wounds;
- Eye damage;
- Lacerations;
- Broken bones;
- Contusions;
- Concussions; and
- Internal injuries.

Less obvious pressure testing injuries include:

- Asphyxiation from the unexpected release and accumulation of inert testing gases such as nitrogen or argon, especially in confined spaces or low lying areas; and
- Electrocutions from flooding in areas where energized electrical sources come into contact with a conductive liquid (usually water).

Workers can protect themselves from all of these injuries when they are provided with an appropriate Standard Operating Procedure (SOP), have the proper training, including safe work practices, and carefully implement the safe work practices in conjunction with the SOP. MCAA recommends that each company establish a pre-test safety plan for each specific pressure testing application. All workers who will be involved in a pressure test should be part of the pre-test safety planning process for that particular application.

## Common Causes of Pressure Testing Failures

Some of the most common causes of piping system failures during pressure testing operations include:

- Over pressurizing a system;
- Inadequate/improper pressure testing equipment;
- Poor system/component design;
- Operator error;
- Inadequate repairs/modifications to a system;
- Failure to properly isolate parts being tested from other parts of a system; and
- Failure to properly isolate equipment from the piping system being tested.

## General Pressure Testing Safety

Now that we've identified seven common causes of piping system failures that can occur during pressure testing, let's look at each of them individually to determine how best to address them.

**Over Pressurizing a System** – To avoid over pressurizing a system the *test pressure* has to be established. The engineer or other qualified person who will make that determination needs to know the *design pressures* for each component in the piping system such as gauges, valves, fittings, etc. that will be included in the test. , Design pressures for components in the system that will be isolated from the test are not considered in the calculation. Design pressures and other vital specifications, such as testing temperatures (certain types of metal become brittle when they get cold) are provided by the manufacturers of the pipe and the other system components. Once the information is obtained, formulas are used to determine the test pressure.

- Determine the test pressure and time.
- Install a calibrated pressure relief valve set to the appropriate release pressure for all tests over 100 psi when pneumatic testing.

- Increase the pressure gradually according to the applicable SOP and ASME standard.
- Never exceed the test pressure.

**Inadequate/Improper Pressure Testing Equipment** – Pressure testing equipment includes items such as gauges, pumps, cylinders, hoses, connections, etc. Test equipment is considered inadequate if it is of poor quality, not designed for the maximum pressure that it will endure, not properly calibrated, and/or not working properly.

- Use only test equipment that is designed and built by reputable manufacturers.
- Use the most current/accurate information provided by the manufacturer to ensure that the equipment is designed for your specific pressure testing application.
- Ensure that the test gauges are calibrated. Refer to the calibration stickers to ensure that the gauges have been professionally calibrated within the past 12 months.
- Check each calibrated gauge just prior to installation to ensure that it is registering zero. If it is not at zero, it is damaged and must be replaced with a properly working calibrated gauge before proceeding with the test.
- Test pressure should register on the gauges as close to the 12 o'clock position as possible. For example, if the test pressure is determined to be 100 psi, select a 200 psi pressure gauge. The test pressure (100 psi) should be at the top of each gauge in the 12 o'clock position.

**Improper System/Component Design** – A system is improperly designed if any single component is inadequate for the application. When any part of the system, such as a fitting, valve, gauge, flange, adaptor, hose connection or flex connector, is not designed to endure the anticipated test pressure, failure will occur.

- Verify proper system design prior to installation. Before performing a pressure test on an unfamiliar system, verify that the engineer or other qualified person has established the original design rating from original data reports or new calculations based on sizes, wall thicknesses, etc.

**Operator Error** – Operator error usually occurs when worker(s) feel rushed or otherwise become distracted. In those instances, workers may fail to follow the established SOP and/or equipment or material manufacturers' guidelines.

- Use the applicable company SOP and ASME standard to prepare a pre-test safety plan.
- Include all affected workers in the pre-test safety planning process.

- Ensure that all affected workers receive the proper training, tools, materials and supervision needed to safely perform the test.

**Inadequate Repairs/Modifications to a System** – Inadequate repairs or modifications to systems can lead to problems. Use of improper fittings, misalignments, rolled or cut gaskets, etc. result in inadequate repairs or modifications, and cause pressure testing failures.

- Carefully inspect all parts of the piping system that will be included in the test before beginning. Pay especially close attention to joints and connections.
- Follow the applicable SOP and ASME standard for the gradual increases in testing pressure.

**Failure to Properly Isolate the Parts of the System Being Tested from Other Parts of the System** – Failure to isolate one or more parts of a system that are not part of the test can result in system failure. For example, failure to isolate a relief valve that isn't designed for the test pressure will activate the valve and unexpectedly release the test medium into the environment under pressure. Even worse, failure to isolate a gauge, meter, or some other component that isn't designed to endure the test pressure can cause it to shatter under pressure creating high-speed flying objects.

- Review the pre-test safety plan, including the piping system drawings, just before starting the testing process.
- Carefully follow the appropriate safe pressure testing procedures contained in your company's established SOP for the specific type of test to be performed and the applicable ASME standard.
- Establish and use a checklist to ensure that you don't inadvertently omit an important part of the isolation process.
- Make sure the checklist includes isolating/blocking parts of the system that are not to be included in the test.

**Failure to Properly Isolate Equipment from the Piping System Being Tested** – Failure to isolate equipment from the system could result in injury or damaged equipment. When equipment arrives for installation it generally has already been tested. And, equipment typically has a lower design pressure than that of the piping system.

- Carefully follow the appropriate safe pressure testing procedures contained in your company's established SOP for the specific type of test to be performed and the applicable ASME standard.
- Establish and use a checklist to ensure that you don't inadvertently omit an important part of the isolation process.
- Make sure that isolating/blocking the equipment is included on the checklist.

## Safe Work Practices for Hydrostatic Testing

### Standard Operating Procedures (SOP)

Establish an SOP for each of your specific hydrostatic testing applications based on the most current/applicable ASME standard and this publication's safety guidelines.

- Use this safe work practices section and the applicable ASME standard to develop your company's SOP for each specific pressure testing application.

### Checklist

Using your SOP for the specific hydrostatic testing application, develop a checklist to help affected workers perform the test safely.

- See Appendix B for a sample hydrostatic pressure test checklist.

### Pre-Test Safety Plan

Develop a pre-test safety plan using the applicable SOP and corresponding checklist.

- Include all affected workers, companies and owners in the pre-test safety planning process.
- Identify the potential hazards and the protective measures affected workers will use to protect themselves from those hazards.
- See Appendix A for guidance on pre-test safety plans.

### Worker Training

Train all affected workers on the hydrostatic test process that will be used for the specific application.

- Use the applicable SOP and corresponding checklist as training resources.
- Ensure that the affected workers understand the potential hazards and how they are to protect themselves from those hazards.

### Pre-Test Safety Briefing

Just prior to performing the hydrostatic test, conduct a pre-test safety briefing.

- Review the pre-test safety plan.
- Ensure that affected workers fully understand the process, the potential hazards and the protective measures.

# Guide to Pressure Testing Safety

- Ensure that affected workers have the proper equipment, materials and personal protective equipment they need to safely perform the hydrostatic test.
- Establish the communication system (two-way radios, cell phones, etc.) that will be used for affected workers to communicate with each other during the test.
- Establish an emergency response plan including emergency shutdown procedures, and provide affected workers with emergency contact information/telephone numbers.

## Walk Down

Carefully perform a walk down inspection of the system. Take the checklist with you so that you don't inadvertently omit critical tasks. Pay close attention to detail as you perform the walk down.

- Identify any adjacent equipment that could be affected by a failure and isolate or otherwise protect the equipment.
- Ensure that the system has been completed according to the drawings and that no ends of the piping system are left open.
- Ensure that the system is vented at all of its high points to bleed out air from the system while it is being filled with the test medium.
- Ensure that all joints and connections are exposed for inspection/evaluation. Remove insulation if necessary.
- Look for damaged components, misaligned segments and anything else that is out of place.
- Ensure that all parts of the system that are not part of the test are properly isolated from the part of the system to be tested.
- Ensure that all necessary lockout/tagout procedures have been completed according to the SOP.

## Final Preparation

Carefully complete final preparations using the checklist to ensure that nothing critical is omitted.

- Make component replacements or repairs, if necessary, before proceeding.
- Once the air pockets are bled off from the system, close off and secure/seal all vents.

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- Verify the test pressure and the design pressure from the system engineer or other qualified person.
- Verify that the test gauges are calibrated. Refer to the calibration sticker to ensure that the gauges have been professionally calibrated within the past 12 months.
- Check the calibrated gauges just prior to installation to ensure that they are registering zero. If they are not registering zero, they may have been dropped and must be replaced immediately.
- Make sure test pressure registers on the gauges as close to the 12 o'clock position as possible. For example, if the test pressure is determined to be 100 psi, select a 200 psi pressure gauge. The test pressure (100 psi) should be at the top of the gauges in the 12 o'clock position.
- Verify that the metal temperature at test time is satisfactory.
- Barricade the test area with red danger tape to keep non-essential personnel out.
- Post warning signs to keep non-essential personnel at a safe distance.
- Ensure that the test equipment is securely connected to the system.
- Use two test gauges, one at the pressure source and one at the highest or furthest point from the pressure source.
- Verify that all non-essential personnel are clear from the area.
- Inform all affected personnel that the test is about to start.

## Personal Protective Equipment

Personal protective equipment is critical in case there is a failure in the piping system during the testing operation.

- Ensure that all affected workers are wearing a hardhat, safety glasses and gloves when pressure testing any piping system. Require the use of face shields and/or hearing protection in addition to the other protective equipment when appropriate.

## Testing

Continue with the checklist to ensure that you don't omit any critical tasks. Remember to verify the maximum allowable pressure for the system and pay close attention to the actual pressure shown on the test gauges.

- Apply pressure gradually according the applicable SOP.

- Never exceed the maximum allowable working pressure of any individual component in the system. Be sure to follow the recommended test pressures cited in the applicable ASME standard. For example, ASME B31.1–2012 Power Piping states that the hydrostatic test pressure should be not less than 1.5 times the design pressure. Make certain that you have the *most current version* of the correct ASME standard for your specific application and follow its recommendations carefully.
- Maintain the hydrostatic test pressure at the recommended level above the design pressure for at least 10 minutes before reducing it to the design pressure. For example, ASME B31.1 – 2012 Power Piping states that the hydrostatic pressure should be maintained at 1.5 times the design pressure (minimum). Once reduced to design pressure, maintain it for the length of time it takes to carefully inspect/evaluate the system for leaks, or according to the customer’s specifications.
- Carefully inspect all joints and connections for signs of leaking.

## Post Test

Carefully follow the SOP to safely, gradually release the pressure from the system and collect the waste liquid test medium when required.

- Release pressure before attempting to repair any leaks. *Never attempt to repair leaks while the system is under pressure.*
- Drain the system.
- If the facility has requirements regarding the collection and/or disposal of the liquid test medium, be sure to follow them carefully.
- Repair any leaks that occur.
- Retest the piping system if necessary.

## Safe Work Practices for Pneumatic Testing

### Standard Operating Procedures (SOP)

Establish an SOP for each of your specific pneumatic testing applications based on the most current/applicable ASME standard and this publication’s safety guidelines.

- Develop a pneumatic testing permit/permit system as part of each pneumatic testing application SOP.
- Use this safe work practices section and the applicable ASME standard to develop your company’s SOP for each specific pressure testing application.

## Checklist

Using the SOP for the specific pneumatic testing application develop a checklist to help affected workers perform the test safely.

- See Appendix C for a sample pneumatic pressure test checklist.

## Pre-Test Safety Plan

Develop a pre-test safety plan using the applicable SOP and corresponding checklist.

- Include all affected workers, companies and owners in the pre-test safety planning process.
- Identify the potential hazards and the protective measures affected workers will use to protect themselves from those hazards.
- See Appendix A for guidance on pre-test safety plans.

## Permit and Approval to Proceed

Complete the permit and get it approved and signed by the appropriate supervisor.

- See Appendix D for a sample pneumatic pressure test permit.

## Worker Training

Train all affected workers on the pneumatic test process that will be used for the specific application.

- Use the applicable SOP, the corresponding checklist and the permit as training resources.
- Ensure that the affected workers understand the potential hazards and how they are to protect themselves from those hazards.

## Pre-Test Safety Briefing

Just prior to performing the pneumatic test, conduct a pre-test safety briefing.

- Review the pre-test safety plan.
- Ensure that affected workers fully understand the process, the potential hazards and the protective measures.
- Ensure that affected workers have the proper equipment, materials and personal protective equipment they need to safely perform the pneumatic test.

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- Establish the communication system (two-way radios, cell phones, etc.) that will be used for affected workers to communicate with each other during the test.
- Establish an emergency response plan including emergency shutdown procedures, and provide affected workers with emergency contact information/telephone numbers.

## Walk Down

Carefully perform a walk down inspection of the system. Take the checklist with you so that you don't inadvertently omit critical tasks. Pay close attention to detail as you perform the walk down.

- Identify any adjacent equipment that could be affected by a failure and isolate or otherwise protect the equipment.
- Ensure that the system has been completed according to the drawings and that no ends of the piping system are left open.
- Ensure that all joints and connections are exposed for inspection/evaluation. Remove insulation if necessary.
- Look for damaged components, misaligned segments and anything else that is out of place.
- Ensure that all parts of the system that are not part of the test are properly isolated from the part of the system to be tested.
- Ensure that all necessary lockout/tagout procedures have been completed according to the SOP.

## Final Preparation

Carefully complete final preparations using the checklist to ensure that nothing critical is omitted.

- Make component replacements or repairs, if necessary, before proceeding.
- Verify the test pressure and the design pressure from the system engineer or other qualified person.
- Verify that the test medium is non-flammable and non-toxic such as air, nitrogen or argon.
- Verify that the test gauges are calibrated. Refer to the calibration stickers to ensure that the gauges have been professionally calibrated within the past 12 months.

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- Check the calibrated gauges just prior to installation to ensure that they are registering zero. If they are not registering zero, they may have been dropped and must be replaced immediately.
- Make sure test pressure registers on the gauges as close to the 12 o'clock position as possible. For example, if the test pressure is determined to be 100 psi, select a 200 psi pressure gauge. The test pressure (100 psi) should be at the top of the gauges in the 12 o'clock position.
- Verify that the metal temperature at test time is satisfactory.
- Barricade the test area with red danger tape to keep non-essential personnel out.
- Post warning signs to keep non-essential personnel at a safe distance.
- Where permitted/appropriate, install a pressure relief valve set to release slightly over the test pressure as determined by the engineer or other qualified person.
- Ensure that the test equipment is securely connected to the system.
- Use two test gauges, one at the pressure source and one at the highest or furthest point from the pressure source.
- Ensure that both test gauges are connected to the system with adaptors made of the same material.
- Verify that all non-essential personnel are clear from the area.
- Inform all affected personnel that the test is about to start.

## Personal Protective Equipment

Personal protective equipment is critical in case there is a failure in the piping system during the testing operation.

- Ensure that all affected workers are wearing a hardhat, safety glasses and gloves when pressure testing any piping system. Require the use of face shields and/or hearing protection in addition to the other protective equipment when appropriate.

## Testing

Continue with the checklist to ensure that you don't omit any critical tasks. Remember to verify the maximum allowable pressure for the system and pay close attention to the actual pressure shown on the test gauges.

- Apply pressure gradually according the applicable SOP and ASME standard.

- Never exceed the recommended pressure above the design pressure at any time throughout the test, but never go below the recommend level under the design pressure. For example, in ASME B31.1 – 2012 Power Piping the recommendation is to never exceed 1.5 times the design pressure, and never test below 1.2 times the design pressure. Test at the lowest possible pressure recommend by the applicable ASME standard. For example, when ASME B31.1 – 2012 is the applicable standard, test at 1.2 times the design pressure whenever possible.
- Gradually increase the pressure to no more than 1/2 the design pressure.
- Continue increasing the pressure in increments of approximately 1/10 the test pressure and maintain it for at least 10 minutes. Repeat the process until the required test pressure has been achieved and maintained for at least 10 minutes.
- Next, reduce the pressure to the design pressure or 100 psig, whichever is lower.
- Maintain the pressure for the length of time it takes to carefully evaluate the system for leaks, or according the customer's specifications.
- Carefully inspect all joints and connections for signs of leaking. Use a liquid leak detector to identify any leaks.

## Post Test

Carefully follow the SOP to safely, gradually bleed the stored energy from the system.

- Release pressure before attempting to repair any leaks. *Never* attempt to repair leaks while the system is under pressure.
- Repair any leaks that occur.
- Retest the piping system if necessary.

## Appendix A – Pre-Test Safety Planning Guidance

Perform a hazard analysis before starting any pressure test. Be sure the analysis is performed as close as possible to the start of the test. And, be sure to:

- Identify the worker who will be responsible for supervising the test;
- Identify each worker who will be performing the test;
- Inform each worker involved in the test about the hazard analysis; and
- Require each affected worker to participate in the hazard analysis.

### Supervisor's Responsibilities

The designated supervisor should be responsible for ensuring that:

- Each worker who will be performing the test has been properly trained to safely perform the work; and
- Each worker performing the test has received the necessary tools and equipment, including the safety equipment identified in the hazard analysis.

The steps for performing an effective hazard analysis are as follows.

1. Break the pressure test down into specific steps (refer to the applicable SOP).
2. Identify and record the hazards associated with each step.
3. Determine the best way to safely complete each step.
4. Develop and record safe work procedures for each step.
5. Include each affected worker in the safe work procedures development process.
6. Perform a pre-test briefing just before the test begins. Include the following topics in the pre-test briefing:
  - Review each hazard that was identified in the hazard analysis;
  - Review each of the established safe work procedures;
  - Determine whether any changes to the safe work procedures are needed due to last minute changes in the scope of work or other last minute changes.
  - Ensure that all of the necessary personal protective equipment is present.
  - Provide each affected worker with a sign-off sheet to indicate that they are familiar with the hazards associated with the test and understand how they are to protect themselves from those hazards. Collect and file the completed sign-off sheets.

## Appendix B – Sample Hydrostatic Test Checklist

### Pre-Test:

- All affected persons informed (Owner, GC/CM, PMs, workers, other trades, suppliers, etc.)
- Design pressure and test pressure established/provided by Engineer or Qualified Person
- Applicable SOP/ASME test pressures identified
- Pre-test safety plan completed/reviewed
- Affected workers properly trained
- Affected workers system of communication established
- All test equipment adequate for required test pressure
- The range for both test gauges is approximately double the test pressure
- Test gauges calibrated – Gauge #1 Date: \_\_\_\_\_ – Gauge #2 Date: \_\_\_\_\_
- Test gauges certified (where applicable) – Gauge #1 Date: \_\_\_\_\_ – Gauge #2 Date: \_\_\_\_\_
- Metal temperature verified/satisfactory
- Test area barricaded with danger tape to keep non-essential personnel at a safe distance
- Warning signs posted to keep non-essential personnel at a safe distance
- Walk down inspection completed
- System complete
- Vent valves closed
- Fill/block valves closed
- Joints and connections exposed
- Valves properly configured
- System parts undamaged/properly aligned

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- \_\_\_ Bolted connections torqued according to manufacturer specifications
- \_\_\_ Lockout/tagout completed where applicable
- \_\_\_ Emergency contact information/telephone numbers established/provided
- \_\_\_ Emergency shutdown procedures established/provided
- \_\_\_ Equipment isolated/blocked from the piping system
- \_\_\_ Other parts of the piping system not included in the test removed or isolated
- \_\_\_ Pressure relief valve properly sized and installed in vertical position

## Test:

- \_\_\_ Test equipment securely attached to the system
- \_\_\_ Test pressure re-verified
- \_\_\_ All non-essential personnel removed from area
- \_\_\_ All affected personnel wearing hardhats, safety glasses and gloves
- \_\_\_ All affected personnel wearing face shields and/or hearing protection where appropriate
- \_\_\_ Pressure applied gradually according to the SOP/ASME standard
- \_\_\_ Pressure maintained according to the applicable SOP/ASME standard/customer specifications
- \_\_\_ All joints and connections carefully inspected for leaks

## Post Test:

- \_\_\_ Pressure released before leak repairs are started
- \_\_\_ Stored energy gradually released according to SOP
- \_\_\_ Liquid test medium collected according to SOP
- \_\_\_ Liquid test medium disposed of properly according to SOP
- \_\_\_ Leak repairs made and system retested if necessary

## Appendix C – Sample Pneumatic Test Checklist

### Pre-Test:

- All affected persons informed (Owner, GC/CM, PMs, workers, other trades, suppliers, etc.)
- Design pressure and test pressure established/provided by Engineer or Qualified Person
- Applicable SOP/ASME test procedures identified
- Pre-test safety plan completed/reviewed
- Affected workers properly trained
- Affected workers system of communication established
- Non-flammable/non-toxic gas for test medium
- Test medium reviewed with affected workers
- All test equipment adequate for anticipated maximum test pressure
- The range for both test gauges is approximately double the test pressure
- Test gauges calibrated – Gauge #1 Date: \_\_\_\_\_ – Gauge #2 Date: \_\_\_\_\_
- Test gauges certified (where applicable) – Gauge #1 Date: \_\_\_\_\_ – Gauge #2 Date: \_\_\_\_\_
- Metal temperature verified/satisfactory
- Test area barricaded with danger tape to keep non-essential personnel at a safe distance
- Warning signs posted to keep non-essential personnel at a safe distance
- Pressure relief valve installed/set to appropriate pressure
- Walk down inspection completed
- System complete
- Vent valves closed
- Fill/block valves closed
- Joints and connections exposed

# Guide to Pressure Testing Safety

- Valves properly configured
- System parts undamaged/properly aligned
- Bolted connections torqued according to manufacturer specifications
- Lockout/tagout completed where applicable
- Emergency contact information/telephone numbers established/provided
- Emergency shutdown procedures established/provided
- Equipment isolated/blocked from the piping system
- Other parts of the piping system not included in the test removed or isolated
- Pressure relief valve installed in the vertical position
- Test medium valve is in the closed position before attachment
- Pressure regulator is fully backed out allowing zero flow

## Test:

- Test equipment securely attached to the system
- Test pressure re-verified
- All non-essential personnel removed from area
- All affected personnel wearing hardhats, safety glasses, and gloves
- All affected personnel wearing face shields and/or hearing protection where appropriate
- Pressure applied gradually according to the applicable SOP/ASME standard
- Pressure maintained according to the SOP/ASME standard/customer specs
- All joints and connections carefully inspected for leaks with liquid leak detector

## Post Test:

- Pressure released before leak repairs are started
- Stored energy gradually released according to SOP
- Leak repairs made and system retested if necessary



# Guide to Pressure Testing Safety

## Appendix D – Sample Pneumatic Test Permit

### XYZ Company, Inc. – Pneumatic Pressure Test Permit

**System to be Tested:** \_\_\_\_\_

Date: \_\_\_\_\_ Start Time: \_\_\_\_\_ Finish Time: \_\_\_\_\_

**Notifications:**

**Initials:**

- \_\_\_ Owner (when applicable)
- \_\_\_ GC/CM
- \_\_\_ Other Affected Trades
- \_\_\_ Safety Department

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**Comments:**

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**Pressure Test Supervisor:**

- \_\_\_ Applicable SOP Established
- \_\_\_ Maximum Allowable Test Pressure Verified
- \_\_\_ Design Pressure Verified
- \_\_\_ Pre-Test Portion of Checklist Complete

Full Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Pressure Test Approvals:**

Superintendent: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Safety Officer: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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