



Lusail Real Estate Development Company

Health, Safety, Security, Environment, Logistics & Quality Department

Lusail Construction Safety Management Procedure – Pressurized Systems

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COMPANY PROPRIETARY INFORMATION

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CONTENTS

- 1.0 DESCRIPTION**
- 2.0 DEFINITIONS**
- 3.0 RESPONSIBILITIES**
- 4.0 PRESSURE VESSEL REQUIREMENTS**
- 5.0 PRESSURE TESTING PLANNING**
- 6.0 RESTRICTED ACCESS**
- 7.0 COMMUNICATIONS**
- 8.0 PRESSURE TESTING AUTHORIZATION**
- 9.0 PRESSURE TESTING REQUIREMENTS**
 - 9.1 HYDROSTATIC TESTING**
 - 9.2 PNEUMATIC/GAS TESTING**
- 10.0 TRAINING**
- 11.0 DOCUMENTATION**
- 12.0 ATTACHMENT**

1. Description

This element of the LCSMP details the guidelines to ensure that vessels, tanks, and pipelines for temporary construction and permanent facility use are designed, operated, tested, and maintained to achieve acceptable safety reliability. This element applies to all Lusail personnel, Contractors, Developers, Consultants and subcontractors working on the Lusail project.

2. Definitions

Term	Description
Job Hazard Analysis (JHA)	A process used to identify the hazards or potential hazards associated with each step of a particular job or work plan in order to uncover hazards and then eliminate, control, or remove them before the work is started
ASME	American Society of Mechanical Engineers
Hydrostatic Test	The use of water to test the integrity of vessels or pipeline systems
Pneumatic Test	The use of compressed air to test the integrity of the construction of pipeline systems, tanks and vessels
Pressure Vessel	A pipe or series of pipes (with or without coupling) with pipes and tanks or other apparatus interconnected and/or tanks and vessels separated (all metals, wall thicknesses, and vessel diameters must be taken into account). Pressure vessels are limited in number and usually involve only compressed air receivers (single and manifold arrangements), temporary heating boilers, and compressed gas tools

3. Responsibilities

The Contractor is fully responsible for the pre-planning, development of Method Statements, Job Hazard Analysis, overall safe work planning and implementation. Project Management is responsible for the assurance that all work is planned and conducted according to the pre-planning documents; Contractor and Lusail Health Safety & Environment (HSE) procedures and the Qatar Construction Specifications 2010. Should a conflict occur between procedures/standards or requirements the most stringent shall apply.

4. Pressure Vessel Requirements

Air receivers must be installed so that all drains, handholes, and manholes therein are easily accessible. Under no circumstances will an air receiver be buried underground or located in an inaccessible place.

The drain valve on the air receiver must be opened and the receiver completely drained at frequent intervals and to prevent the accumulation of liquid in the receiver.

Every air receiver must be equipped with an indicating pressure gauge (so located as to be readily visible) and with one or more spring-loaded safety pressure relief valves. No valve of any type will be placed between the air receiver and its safety relief valve, or valves.

Pressure testing must be conducted in accordance with manufacturer's recommendations and preventive maintenance programs, and in accordance with Lusail pressurized line testing requirements

5. Pressure Testing Planning

The Contractor Project Manager oversees the development and implementation of the project pressure testing plan, including specific provisions for compliance with this Lusail Procedure. The Project Manager designates employees to conduct activities within the plan.

Contractor personnel are responsible for identifying planned pressure testing activities during risk mitigation planning (2-week look-ahead). The Contractor is required to work with their Supervising Consultant to ensure all aspects of this Procedure are adhered to, and the Contractor has planned the event(s) accordingly.

The pressure testing plan may be contained in the project site-specific health and safety plan. The Contractor need prepare a Method Statement (MS) for each pressure testing event which is specific to the parameters of the test environment.

A Job Hazard Analysis (JHA) need be developed and reviewed with all personnel involved in the test event prior to the event occurring. All personnel must be made aware of the potential hazards should test object failure occur, and how to response should a failure occur.

The JHA shall give consideration to the following issues:

- Adjacent operating materials, equipment, or processes that could be damaged from a rupture of the system under test.
- Flammable gases present from nearby operations that could ignite as a result of a test failure.
- The test system volume, test pressure, types of components, test temperature, and materials of construction are factors that affect the degree of danger involved and the precautions to be taken.
- Hearing protection.

6. Restricted Access

Only authorized persons equipped with adequate PPE are permitted to approach the vessel or system under test. These persons must have reviewed the JHA and MS.

Use warning signs and barriers to restrict bystander access to systems under test. Signs shall be placed on test vessels, tanks, and at every twenty five (25) meter intervals on pipeline systems under test.

Station guards at all possible entrances to the test area. Ensure that at least two guards are able to view the entire test area to ensure that no one enters the test area during the test.

Where possible, particularly in the case of high-pressure air or gas testing, conduct tests after regular working hours or on weekends.

Approach a vessel or system under test only after the system is allowed to stabilize. After the maximum test pressure is attained throughout the system, wait 5-20 minutes before allowing personnel to approach the system components. Never get directly in line of ring flanges while equipment is under test.

7. Communications

Establish and maintain a system of communication(s) between the person monitoring the primary pressure test gauge and the pressure source operator for the duration of the test. System safety monitors (guards) should also be provided with means of communicating with these personnel, and each other.

The Contractor shall utilize the appropriate ASME codes and specification pressures required for specific vessels, tanks and systems based on size, material, and intended use.

Copies of the test index, test packages, and all calculations relevant to the proposed test and American Society of Mechanical Engineers (ASME) codes used must be provided to the Supervising Consultant for review. Copies shall be provided to Lusail HSE or other Lusail representatives upon request.

8. Pressure Testing Authorization

The Lusail Permit to Work Program (PTW) includes work activities involving the pressurization of system, process, equipment pipe works or lines due to the potential for catastrophic failure of the system resulting in property and personal damage/ injury. Pneumatic tests of any air pressure and hydrostatic tests of sixty (60) pounds per square inch gauge (psig) or greater require a Lusail Pressurized Line Test Permit (Attachment in [LUS-HSE-FM4-446-062](#)).

The Contractor shall apply for and acquire an approved pressurized line test permit prior to pressurizing any individual vessel, tank, pipe or pipe system. The Contractor shall provide the Supervising Consultant with the JHA and Method Statement for the proposed test event and both shall walk the test area down prior to the permit being issued.

Pressurized line test permits shall be made valid for the planned duration of the test. Typically, this ranges between four (4) hours and seventy-two (72) hours. Should the test require extension, a new permit shall be applied for and acquired from the Supervising Consultant.

The Contractor is required to post copies of the permit at twenty five (25) meter intervals along system components/pipelines under pressure. The Contractor is also required to clearly sign post the maximum test pressure being implemented on the system at the same interval. The permit and all test notification signs shall remain in place until the completion of the test unless terminated prior to test completion due to system failure.

A pressurized line test permit will automatically terminate upon system failure. Where no failure occurs, the Consultant shall terminate the permit at the completion of the test period or upon discovery that a line has been over-pressurized.

9. Pressure Testing Requirements

Construction air receivers connected to air compressors (mobile or stationary) or used as part of a plant compressor system must be constructed, installed, tested, and maintained in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII (current edition).

Where practical, take steps to minimize the internal volume of the system to be tested. This precaution reduces the energy stored in the system under pressure, thus reducing the consequences if a component fails. This approach can usually be achieved by breaking a large system into smaller systems and by placing metal or dense hardwood cores inside the test units. Take care to ensure that openings in the test unit or system are adequately secured and sealed before testing is started.

Hydrostatic tests on air receivers (both for mobile and stationary compressors) furnished by approved manufacturers do not require tests. Auxiliary tanks and associated pipelines selected as air receivers are to be tested hydrostatically before initial use.

Test safety pressure relief valves and gauges before placing them in service for the first time and every six (6) months thereafter. Gauges are calibrated on six (6) month intervals and a dated sticker is affixed to each gauge.

Test air receivers hydrostatically to 1½ times (150%) the maximum designated working pressure.

Test safety pressure relief valves in accordance with the stamped information on each valve.

Set safety pressure relief valves to operate at a pressure not to exceed the maximum allowable working pressure (MAWP) stamped on the vessel. The relieving capacity must be sufficient to prevent a rise of the pressure in the vessel of more than 10% above the MAWP.

Ensure that manufactured air receivers (including portable air tanks) purchased for temporary construction use have an ASME nameplate or stamp affixed to them before installation or use.

Allow each increment level to stabilize, and then check for leaks. Systems containing aluminum, copper, or any other soft metal, as well as systems containing pipe diameters greater than 10 cm (4"), require special consideration because of volumetric content (gas), resultant gross weights (water), and supports and other consequential secondary possibilities of an undesirable nature that would increase the hazard.

Hydrostatic Testing

When possible, use hydrostatic testing to determine the pressure integrity of a vessel or system. In hydrostatic tests, ASME test specifications involving the working stress of the weakest part or segment must be followed and not exceeded. It is also important to physically disconnect the source of pressure when making final readings on test instruments connected to the vessel entrainment.

Chemicals or fluids such as alcohol and kerosene (or their substitutes) are not desirable for use in hydrostatic testing, and may be used only with special request made by the Contractor to the Supervising Consultant and Lusail HSE Department.

Pressure vessel testing requires that all vessels and connected piping that have had prior use be cleaned before the tests are conducted.

Hydrostatic testing at the point of erection has been objectionable because of the undesirability of residual moisture that is not chemically compatible with the operating fluid. In the matter of residual moisture, the procurement and

application of dehumidifying air drying and heating equipment must be sufficiently investigated for application. Adequate dryers could eliminate a majority of air test specifications or requests.

Pneumatic/Gas Testing

When hydrostatic testing is not permissible, pneumatic testing is the first alternate choice.

The drawings or forms submitted as part of the Method Statement to the Supervising Consultant for approval of a pneumatic test must specify the following:

- Types of components being tested
- Materials of construction
- Test system volume
- Test pressure (full and reduced for examination)
- Test temperatures (ambient at test unit maximum and minimum)
- Test medium
- Test location
- Customer or project involved
- The piping arrangement and materials proposed to connect the test medium to the circuit being tested

When gases other than air are introduced for pressure testing, such gases must be inert and non-toxic. The testing gas and the ultimate operating gas or fluid must be compatible. At the completion of any inert gas test, make arrangements to vent the gas to the outside ambient atmosphere and not into the building or tunnel structure.

Pneumatic testing may be conducted with either air or dry nitrogen. The final choice of test medium must be made by the test engineer and Supervising Consultant:

- Air is generally preferred for large-volume systems because it is more economical and because it is less hazardous than nitrogen. However, dry, oil-free air may be difficult to obtain. The compression equipment required for the test may also be hard to obtain. Thus, it may be necessary to use dry nitrogen as the test medium.
 - If nitrogen is used for pneumatic testing, the test crew is trained on nitrogen properties, health hazards, and first aid before testing begins, in accordance with [LUS-HSE-WG3-446-010](#), Control of Substances Hazardous to Health. All other persons expected to be near the test area must receive the same training.
- No one may enter an area containing a high concentration of gaseous nitrogen without using a self-contained breathing apparatus.
- Contractor shall conduct oxygen concentration monitoring throughout the test area for duration of test using nitrogen. Should oxygen concentrations fall below 19.5% the test area shall be cleared of all personnel and the test terminated.

As in hydrostatic testing, physically disconnect the source of the pressure after the test pressure has been achieved. Piping systems and vessels under test must be equipped with a safety pressure relief valve set to a pressure no more than 10% above test pressure. Do not test systems containing brittle or frangible material such as cast iron.

If, and when air or gas is taken from compressed gas cylinders instead of from a compressor, the 2,200+ lbs. available in commercial cylinders must be adequately regulated and controlled to provide the test pressure desired in the vessel and to prevent over-pressurizing.

Regulators used for test purposes are used *only* for testing and inspection and shall be painted white. This is necessary to avoid possible oil contamination of a regulator and later use with oxygen.

For tests exceeding normal operating pressure (hydrostatic, air, or gas), blank off and tag instrumentation and/or any other auxiliary service lines (except those directly encompassed to reading in the test).

10. Training

The Contractor shall train all personnel involved in a pressure test event on the requirements of this Procedure and the hazards associated with pressurization and testing of vessels, tanks, and pipeline systems.

The HSE Representative arranges employee training before testing and when test parameters are modified. This training can be organized and presented to groups or on a work area by work area basis, depending on the operation.

All employee training shall be documented and records of training retained in project office files for the duration of the project.

11. Documentation

The records custodian documents and maintains all instruction and training records and archives them at project close.

The test engineer maintains testing and inspection records at the site for the duration of the project and archives them for a minimum retention time of 10 years from creation date.

12. References

Qatar Construction Specifications 2010 Section 1 Part 10.3 "Special Safety Precautions"

Qatar Construction Specifications 2010 Section 11 Part 2.3.11 "Permit To Work Systems"

ASME Boiler and Pressure Vessel Code, Section VIII (current edition)

13. Attachments

[LUS-HSE-FM4-446-062](#)

Pressurized Line Test Permit