

# GUIDE TO LOCAL FABRICATORS OF PRESSURE VESSELS

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## 1 Introduction

Recently a fatal accident occurred in a factory in Singapore where a pressure vessel that was undergoing a pneumatic test using nitrogen gas, exploded. This Guide is specifically prepared to highlight the safety issues involved to the manufacturers that fabricate and test pressure vessels.

## 2 What is a pressure vessel?

A pressure vessel is a container, a tank or a vessel, which is subjected to an internal pressure higher than atmospheric pressure during use.

The vessel may, while it is subjected to the internal pressure, be holding or containing any substance either in the form of a gas, a liquid or a powder.

## 3 Why is a pressure vessel potentially hazardous?

A pressure vessel is a potentially hazardous piece of equipment as it is under pressure and it may fail without warning during tests or use.

Any design or fabrication fault or misuse of the vessel could lead to an explosion. A number of such explosions have occurred around the world (including Singapore) causing extensive damage to buildings, properties and considerable loss of human life. Therefore, it is essential that the design, fabrication and use of these pressure vessels be stringently controlled in order to ensure that they are safe for use.

## 4 How to assure safe design, fabrication, tests and inspections of pressure vessel?

The following considerations are necessary to assure the safe design, fabrication, tests and inspections of a pressure vessel:

### (a) Design

The pressure vessel should be designed to an approved code. The code will specify the requirements for design, manufacture, tests and inspection of the pressure vessel. The code therefore serves to ensure that the pressure vessel to be fabricated has been adequately designed to serve its purpose.

### (b) Fabrication

The pressure vessel should be fabricated in accordance with the design calculations and drawings, and the method of construction as stipulated by the approved code.

Where welding is involved, the welding procedures and specifications described in the code for the pressure vessel should be followed strictly. It is also necessary to ensure that the welders tasked to carry out the welding of pressure vessel are competent to carry out the type of welding required by the design code.

A competent inspector should be engaged to survey the fabrication of the pressure vessel to assure that it complies with the design calculations and drawings, and the method of construction stipulated by the approved code.

**(c) Tests and Inspections**

Tests and inspections form a very important part of the process of making sure that the pressure vessel fabricated can withstand the pressure and temperature to which it will be subjected.

Where required, non-destructive tests such as dye penetrant tests and radiographic tests could be carried out on the welds to detect cracks and other defects.

Pressure tests of the vessel should always be conducted using water (hydrostatic test) or an incompressible liquid (hydraulic test). It is not recommended that air or any other gas be used for pressure tests. This is because air/gases are highly compressible and could result in an explosion in the event of a rupture during the tests.

**5 Conclusion**

Pressure vessels are potentially hazardous equipment and should be designed and fabricated to an approved code.

Pressure tests of a pressure vessel should be carried out using water or an incompressible fluid.

The factory occupier and the employer have to draw up safe work procedures for the fabrication and testing of pressure vessels. They have to ensure that their workers are briefed on these procedures and trained to deal with the hazards arising from the hazardous processes in the course.

Note: The above serves only as a general guide to safe design, fabrication, tests and inspections of pressure vessel. It is recommended that reference be made to the relevant codes for specific details.