

Storage tanks

Oil storage tanks have long been one of the important needs of the oil industry in Iran and in all countries of the world. The standard of construction of storage tanks is standard API650 while pressure vessels are built up according to ASME section VIII. Tanks have different types, each of which is used according to their characteristics and application. The selection of a tank and its arrangement and location also depends on the conditions and place of use and the type of use of the tank. Take.

Fluid storage needs special requirements due to their physical properties; for example: storing a highly flammable substance such as gasoline is quite different from storing water. There are different applications for storage in the industry, which are:

- Storage of input materials and feed units
- Storage of intermediate materials, which is produced in the process
- Store the products
- Store materials for loading and distribution
- Equalization of products quality
- A criterion for measuring the volume of feed and product



Traditional design methods that used to be based on manual calculations have now been improved with the use of tank design software. The design of the tanks is done using ETANK and TANK 2012 commercial software. These two software are the latest additions of APIs 650 and 653 of the latest versions and can consider the design of tank roofs, seismic and wind design, anchor design and so on.

Classification of storage tanks

There is no unit classification for storage tanks. This classification can be based on geometry, type of fluid and vapor pressure of the stored liquid in the tank. A brief description of the types of tanks is written as follows:

1- Open top storage tanks

Open top storage tanks are the simplest type of tanks, and are in the form of roofless walls. Due to the lack of roof and fluid contact with the outside environment, this type of tanks is used to store materials such as the ones which:

- Their volatility rate is very low, because high volatility rate causes the material to evaporate and lose.
- Do not have flammable properties, as there is a possibility of fire.
- Materials should not be expensive, as the material may become contaminated unless the purity of the fluid is of little importance or it is treated before use.

These storage tanks are generally in large size. Open top tanks are usually made in the range of diameters up to 70 meters and depths up to 7 meters and sometimes larger. The material of these tanks may be steel, concrete, etc.

Among the substances that are stored in these tanks: water, salt water, chemical fertilizers that are in the form of slurry, etc. can be mentioned.



2- Closed top tanks

Gases, flammable liquids, hazardous chemicals such as acids or bases, and fluids emitting toxic gases must be stored in closed containers. Closed top tanks include floating roof tanks, fixed roof tanks, spherical tanks, cylindrical tanks and refrigerated tanks.

2-1- Floating-roof tanks

Materials such as crude oil, whose vapor pressure is slightly higher and is about 0.5 psi, are stored in special tanks equipped with floating roofs. This type of floating roof has no fixed roof and is called External Floating Roof. These tanks are suitable for non-toxic or low-flammable materials.



If the vapor pressure of a substance is in the same range, but the substance is toxic or flammable, a special type of tank with a floating roof, which also has a fixed roof, is used. These types of tanks are called Internal Floating Roof.



2-2- Fixed-Roof Tanks

This type of cylindrical, vertical, and with a fixed roof is standardized based on the most appropriate diameter and height to provide the required capacity and is used to store various petroleum products.

If the vapor pressure of the material is not high but the material is toxic or flammable, such as heavy petroleum compounds, tanks with fixed roofs are used which are much safer than open tanks. The pictures below show the process of construction of fixed roof tanks by **Lian RAG CO.**



Fixed roof tanks come in a variety of shapes, including domed, conical or canopy roofs. Cone and dome roofs are more common. Operationally, conical roofs are more common, but domed roofs are more robust. In the next section, each of these tanks is described.

- **Supported cone roof:** A roof is a cone that is placed on the beams and columns by means of braces or on trusses with columns by means of braces.
- **Self-supported cone roof:** This conical roof rests only on its perimeter.



- **Self-supported dome roof:** This type of roof is spherical and relies only on its environment. Figure 5 shows an example of a tank with a domed roof.



- **Self-supported umbrella roof:** It is a kind of the dome roof tank that has been modified, each horizontal part of which is a regular polygon.



2-3- Spherical and cylindrical tanks

In cases where the vapor pressure of the material is around 0.5-50 psi, pressurized tanks, such as spherical tanks or horizontal cylinders, are used. Of course, in this pressure range, horizontal cylindrical tanks are preferred, but depending on the operating conditions, sometimes spherical tanks are used and in vapor pressures above 50 psi, spherical tanks must be used.



2-4- Refrigerated tanks

Refrigerated tanks are used to store liquefied gases and materials with low boiling points and often below 0°C. The low boiling point of these materials causes most of them to be gaseous

at normal ambient temperature. Therefore, to prevent evaporation of these materials, they need to be stored at low temperatures.

The most economical and safest temperature for storing these gases is slightly lower than their boiling point and in liquid form. For example, butane gas at 0°C , butadiene at -4°C , ammonia at -33°C , propane at -42°C , ethylene at -103°C , argon at -186°C , nitrogen at 196°C -, hydrogen is stored at -253°C and To keep these gases liquid, they can also be stored at high pressures and ambient temperatures, but there are several reasons why storage at low temperatures and atmospheric pressure has advantages over storage at high pressures and ambient temperatures.

