UNDERSTANDING ACETYLENE

Wilhelmsen Ships Service supplies oxy-acetylene welding and cutting equipment and gases to many of the vessels on the world's oceans. Following the last issue's article on Oxygen, we focus this time on acetylene, which is a more complex gas.

Production

Acetylene is produced mainly through two processes:

- Chemical reaction of Calcium Carbide with water resulting in acetylene (C_2H_2) and lime sludge. This can be done on site at cylinder filling plants as the installations are relatively small.
- Cracking long hydrocarbons molecules (crude oil) as done in the petro-chemical industry. This is a large scale process and requires a lot of space. The petro-chemical industry uses acetylene for the production of all kind of base chemicals and polymers.

Properties

Acetylene (C_2H_2) is used in combination with oxygen (O_2) for welding and cutting because of the extreme heat it generates when it burns. The extreme heat is mainly a result of the chemical instability of the product. Some basic data is:

Flame temperature	: 3070 ºC
Heat of combustion	: 13900 kcal/m^3 = 3300 kJ/m^3
Ignition temp	: 296 ºC
Flammability limit in air	: 2.2% - 80%
Flammability limit in oxygen	: 2.8% - 93%

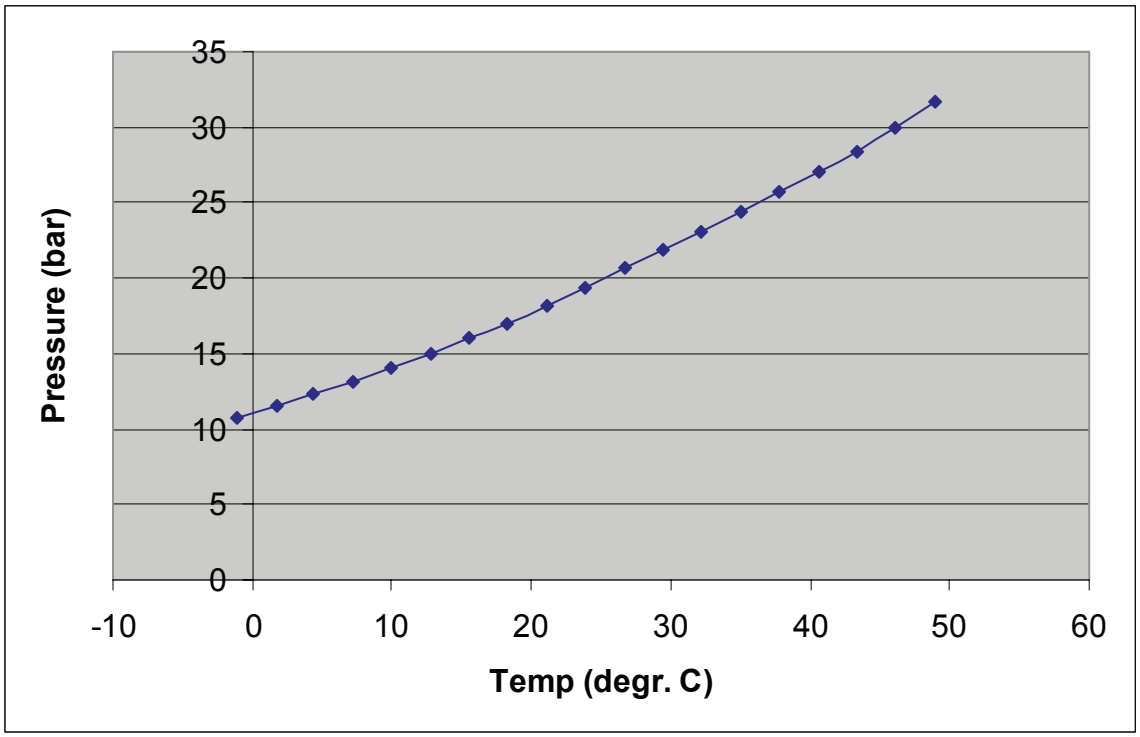
Because of these properties, it is ideal for welding, brazing and oxy-cutting processes. However, the downside to these good properties is that above 2 bar acetylene can, under certain conditions, auto-ignite at room temperature. This means it will start decomposing while generating a lot of heat and pressure. In order to transport acetylene safely in an economical way, it is dissolved in acetone and transported in cylinders filled with a monolithic porous material. A 40 litre acetylene cylinder will hold approximately 12-13kg of acetone in which we can dissolve 5500 litres of acetylene.

Special Effects

The acetylene is actually dissolved in the liquid acetone which is held in porous material. This can have some strange effects:

- When the cylinder is transported horizontally, the acetone will slowly redistribute in a horizontal manner. If the cylinder is placed vertically again, it will take a long time before the acetone is back in its original position. The result is that liquid acetone comes out with the gas-flow of acetylene in the torch. This can have a dramatic influence on the torch flame; it becomes very unstable. This is often referred to as "spitting" as it looks like spitting. If a cylinder has been transported or stored horizontally, you should wait at least 2 days after placing the cylinders in its normal vertical position before using them.

- Always transport and store the acetylene cylinders vertically and ensure that the safety cap is placed correctly over the top valve of the cylinder. Vertical racks should be used during transport and special wall-mounted brackets should be used for storage onboard not only ensuring vertical storage but also quick removal in case of a fire.
- The gas is released from the liquid at a fixed rate. If the consumption of gas is higher than the release rate, pressure will drop quickly. After leaving the cylinder to stand for a short period, the pressure will build up again as acetylene is released from the acetone.
- The pressure of the acetylene inside the cylinder is dependant upon the temperature and the amount of acetone in the cylinder. For a fully charged cylinder, the graph below demonstrates how the pressure inside the cylinder varies with temperature.



The drawbacks

Acetylene has a few more negative properties. It can form chemical compounds (acetylides) when in contact with metals such as copper, silver and mercury. These compounds are highly explosive and potentially dangerous. It is for this reason that brass with higher copper content than 66% should not be used (sometimes 70% is mentioned). The silver content should stay below 46%.

Still the most popular

Despite negative properties, acetylene remains an all-purpose gas for welding, brazing and cutting due to the fact it is so easy to use. Provided all the welding

equipment is up to standard and the gas is used as it should be, it will continue provide a safe and effective way of welding and cutting of steel.

What we can do for you
Wilhelmsen Ships Service is the global supplier of Unitor gases. However, our service doesn't stop there. We have extensive knowledge of welding processes, and we are able to share this knowledge with our customers in a variety of ways: on our website, and through publications such as our Welding handbook. We have a reputation for setting high quality standards in the maritime industry, and we do our best to ensure that our customers benefit from our experience.

Cylinder safety:
Many vessels go for years without any dangerous incidents related to cylinders, and it is understandable why sometimes crew members can become relaxed towards cylinder safety. However, when things do go wrong, they can go dangerously wrong. Gas released under high pressure can turn a docile cylinder into a dangerous projectile, causing serious injury or death.
Important guidelines:

- Do not attempt to disconnect cylinders from fire fighting systems, without the assistance of qualified technicians, to ensure that the quick-release mechanism is properly disarmed and secured.
- Do not lean over a fire extinguisher when activating the plunger, to avoid being hit in the face by parts of the mechanism or the gas flow.
- Buy only good quality cylinders from a reputable supplier. Cheap substitutes may look all right on the outside, but may contain sub-standard materials which are unable to withstand the stresses that are present when a cylinder is stored or activated.

Wilhelmsen Ships Service supplies regulatory products and services, Unitor marine products, Nalfleet marine chemicals, maritime logistics and ships agency.

Wilhelmsen Ships Service has the world's largest maritime services network, with 4,600 marine professionals servicing 2 200 ports in 125 countries. Wilhelmsen Ships Service supplies regulatory products and services, Unitor marine products, Nalfleet marine chemicals, maritime logistics and ships agency to the maritime industry. Last year the company made 214 000 product deliveries to 23 000 vessels and handled 54 000 port calls.

For more information, see www.wilhelmsen.com/shipsservice or contact wss.marketing@wilhelmsen.com