HOUSEWIVES often face a common problem while cooking: They don’t know whether there’s enough gas left in the LPG (liquefied petroleum gas) cylinder to cook the next meal. This problem can be solved by the introduction of cylinders in which the level of available gas in cylinder will be visible by naked eyes. These are lighter and transparent fibreglass domestic cooking gas cylinders. Let us first take a look at cooking gas and the conventional cylinder.

Domestic Cooking Gas
Liquefied petroleum gas (LPG), used as domestic cooking gas in around 40% houses of India, is a mixture of hydrocarbons. As per government definition “liquefied petroleum gas” means any material that comprises predominantly of any of the following hydrocarbons or mixture of them with vapour pressure not exceeding 16.87 kg/cm$^2$ (gauge) at 65º C – propane (C$_3$H$_8$), propylene (C$_3$H$_6$), butane ((C$_4$H$_{10}$), (n-butane and iso-butane) and butylene (C$_4$H$_8$).

Domestic cooking gas is a mixture of propane and butane and has a very high energy content (calorific value = 46.1 MJ/kg). LPG is a low carbon emitting hydrocarbon fuel, emitting 19% less CO$_2$ per kWh than oil and 30% less than coal. The gas can be liquefied at moderate pressure, and can be stored in cylinders as a liquid under pressure, and is drawn out and used as gas. LPG is a colourless and non-poisonous gas. However, at the time of production, mercaptan (a chemical compound) is added to it so as to give the now familiar foul smell for easy detection of gas in the air. Even very small quantities of gas can be detected by this smell.

Since LPG is almost twice the weight of air it tends to settle down at floor level, particularly in depressions. Hence, care has to be taken in placing the gas installations in the house. Also the fact that 1 cubic centimeter of liquid LPG expands to about 270 cubic centimeters of gaseous LPG, helps it spread very rapidly in the atmosphere. Hence, if a gas cylinder leaks, it should be immediately removed to an open area.

Cylinders for Cooking Gas
As per Indian government norms, the domestic cooking gas cylinder should be made in two halves welded at the centre. It should be made of welded low alloy steel conforming to IS:14899 specification. However, cylinders of other origin like Austria, Argentina, China, Italy, Spain, Japan, Poland, UK, USA and Germany are also adopted in India.

Since LPG is inflammable and accidents due to cylinder burst are regular headlines in newspapers, utmost care must be taken to store, use and transport the cylinders. Liquefied petroleum gas cylinders should always be kept in an upright position and placed such that they cannot be knocked over. Condensation on the body of the cylinder metallic is an indication of higher than specified consumption rate of cooking gas. This must be watched and corrected in time to prevent any eventuality.

All gas cylinders have a marking pertaining to their shelf life. Each cylinder necessarily undergoes hydro-testing after 10 years and subsequently at each 5 years. The date of next hydro-proof pressure test is indicated on one of the three stay-plates (top section) of the metallic cylinder in alphanumeric codes. The first letter is an alphabet A, B, C, or D indicating quarter of year. It is followed by two numbers indicating year of next testing. For example, B15 means next proof pressure test for the cylinder is due in second quarter of 2015.

Depending on the metallic sheet used in manufacture of cylinders, the weight is found to vary from 15.5 kg to as high as
Composite material offers several advantages over conventional metallic counterparts. It has very high strength to weight ratio, has excellent corrosion resistance and good fire retardant properties can be introduced by incorporating special additives. Higher internal damping, less catastrophic burst failure, better dimensional stability due to low coefficient of thermal expansion, lower life cycle cost, improved appearance and smooth surface make composite materials an obvious choice for various applications.

Composite Gas Cylinders
Metals, plastics, ceramics are considered materials with different distinguishing characteristics and composite materials are mixtures of two or more of these. Bones, wood etc are naturally occurring composite materials. Reinforced cement concrete is the modern incarnation of the composite material concept. In modern scenario, composite materials are fast getting introduced as aircraft structures, car-bodies, railway coaches, boat construction, naval crafts, storage tanks and vessels, engine pistons, sewer pipes, polymer concretes for dams, roof-light sheets, electrical masts and spars, chairs, tables, implants, sport-goods, cooking utensils, personal armours, etc.

A composite material offers several advantages over conventional metallic counterparts. It has very high strength (or stiffness) to weight ratio. It has excellent corrosion resistance and good fire retardant properties can be introduced by incorporating special additives. Higher internal damping, less catastrophic burst failure, better dimensional stability due to low coefficient of thermal expansion, lower life cycle cost, improved appearance and smooth surface make composite materials an obvious choice for various applications.

A see-through, lightweight, safe, eye-catching, environmental friendly cooking gas cylinder made of fiberglass will be an asset for kitchens of the future. Composite gas cylinders apart from imparting maximized strength and optimized safety, also offer additional advantages like non-corrosive construction, high strength to weight ratio, light weight, and explosion-proof fabrication making this an obvious alternative for domestic cooking gas cylinders. This type of technology needs adaptation for many other reasons also.

In India, LPG supply is highly subsidized (50%) and is theft prone also. Some distributors take out the LPG from the cylinders by filling water up to 2 kg and the water remains in the cylinder even at the time of refilling at bottling plants. Additionally, wide variation in weights of LPG cylinders (15.5 kg to 18.5 kg), erroneous tare weighment during bottling, black-marketing are some of the menace for which this composite domestic gas cylinder is considered a panacea.

In a LPG bottling plant, automatic LPG filling system called carousal is adopted. It has 24 nozzles and can undergo one rotation in 65 seconds giving a time of 2.5 seconds per cylinder to the operator for tare neutralization. This frequently leads to erroneous gas weight in the cylinder and the specified variation of $\pm$150g over 14.2 kg gas is seldom maintained. The plastic seal costs too less for any malpractices. The use of gadgets like Bansuri, etc. has been reported widely to take out cooking gas from filled cylinders before resealing it. Cases of filling the cylinders with 1-2 kg of water displacing LPG gas has been reported from many parts of the country. A see-through visible gas level will put an end to all such malpractices.

The major problem with use and propagation of composite cylinder is high cost of fabrication. The cost is priced at around Rs 3,500 per cylinder in comparison with Rs 950 for steel cylinders. However, the cost is largely justified in view of enhanced safety, correct and justified return on investment, higher buying capacity of domestic LPG gas users, prior intimation of available gas level, light weight and next generation tag.

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