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When is a Litre not a Litre?
Temperature Compensating Fuel Dispensers

Ever wondered why the number of miles you got out of your last tank of petrol varied slightly from what you got the time before? Perhaps the answer lies in the temperature of the fuel you filled up with. As temperature rises the amount of energy contained in the same volume of fuel decreases.

To ensure that the same amount of energy is received each time you fill up the dispenser can be designed to compensate for temperature differences in the fuel.

This type of compensation can reveal itself in other ways for example how will you react when you think you can get only 50 litres of petrol into the tank of your car and notice that the dispenser records a sale of 51 litres – with an indication that the measurement is corrected for 15 degrees Celsius (15^{o} C)? In practice you probably will not notice, at the time, the different quantity dispensed, but you will see the display stating that there has been a correction.

We may think that we understand measurement and that if we measure something, we will have got it right, and everyone will agree on the result. The reality is actually a bit more complicated. Measurement of something may be an absolute value, or a comparison, but if we cannot agree on the basis of this measurement, it becomes meaningless.

At first sight, volume appears to be defined by an absolute constant since the SI system defines a litre by reference to a cubic measurement which is itself length based. This simple concept is however confused by the fact that a given mass of liquid will have different volumes dependant upon the temperature at which the measurement is made.
This means that when a consumer makes assumptions about how far their vehicle will travel based on a volume of fuel that has not been corrected for temperature the calculation becomes less precise

When we buy petrol, we are buying energy. If petrol were sold by mass, we would always know the amount of energy that we were buying, but we would not automatically know the volume we had put in our car tank. If we lower the temperature of the petrol we purchase, we will get a greater mass of petrol, and hence energy, in a given volume. This is why the temperature limits of petrol dispensed into Formula 1 race cars are controlled – the cooler the petrol, the more energy you can put into the race car's petrol tank.

Where fuel at higher than ambient temperature is delivered to a forecourt with a very quick throughput, retail customers may buy petrol which subsequently cools and contracts in their car fuel tank, and they might notice a slight reduction in miles covered from that tankfull. Conversely cool fuel which subsequently warms and expands in the car fuel tank might provide a slight increase in miles covered.

To take this into account fuel dispensers can make sales of fuel by reference to standard conditions. Standard Temperature Accounting (STA) introduces a correction whereby fuel is sold by reference to what its volume would be at a temperature of 15 degrees Celsius. This then gives a "Standard Litre" and enables a more consistent price comparison over time to be made by customers based on how much energy they have actually purchased.

Automatic temperature compensation has been used on forecourt dispensers in Canada for a number of years and is shortly to be made mandatory in Belgium. The implementation of the Measuring Instruments Directive makes it easy for manufacturers to produce a single forecourt dispenser design that is approved throughout the European Union and so it is likely that we will soon see forecourt dispensers in the United Kingdom which feature automatic temperature compensation. For retail delivery of liquid fuel eg by fuel dispenser, there is however, no legal requirement for STA in the United Kingdom and therefore traditional, non-STA fuel dispensers can continue to be used. These dispensers will continue to give accurate volume measurement. For motorists who monitor their fuel use over longer periods of time the slight variations in the total energy delivered due to the differences in temperature of the fuel delivered will for the most part be balanced out across the country and over the year.

Important Points

General

- The number of miles you get from a litre of petrol is very slightly affected by its temperature. STA fuel dispensers compensate for that fact.

- So far only a small number of STA fuel dispensers have been introduced, but it is a legal requirement that these fuel dispensers are clearly marked to tell the customer it is operating under that system.

- The customer is free to choose whether to use an STA fuel dispenser or not and as with all fuel dispensers their use will be monitored by local trading standard officers.

Will you get less petrol with STA fuel dispensers?

- This depends on the temperature of the petrol. Sometimes you will get more. The effect is typically very small making less than half a per cent of difference and because petrol is stored in underground tanks its temperature actually doesn't vary that much. Unlike the standard fuel dispensers you will always get the same energy value for the fuel you buy.

- It is because the relative difference is so small, that we have not mandated the wider introduction of STA fuel dispensers.

Is this a case of interference from Brussels?

- No – STA fuel dispensers are not compulsory. They are permissible under both UK and EU legislation.

Why haven't you made STA compulsory – like Belgium?

- The costs of adapting all existing fuel dispensers or restricting retailers to the use of STA fuel dispensers would far outweigh any benefits from STA. The consumer is free to choose whether to purchase from an STA fuel dispenser or not.

Background

The manufacturers will provide the markings to go alongside the volume displays to indicate they are STA fuel dispensers. The marking will take the form of 'L @ 15 ^{o}C' or something of a similar nature either in words or symbols.

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