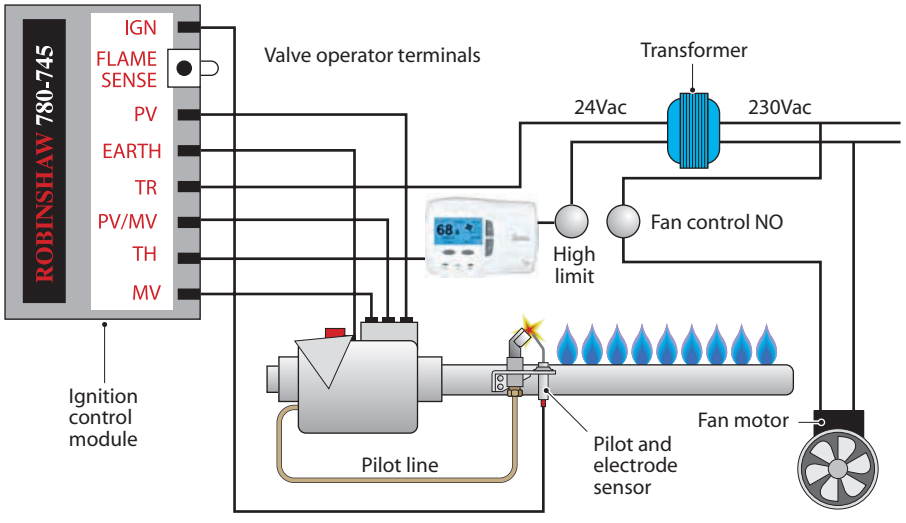
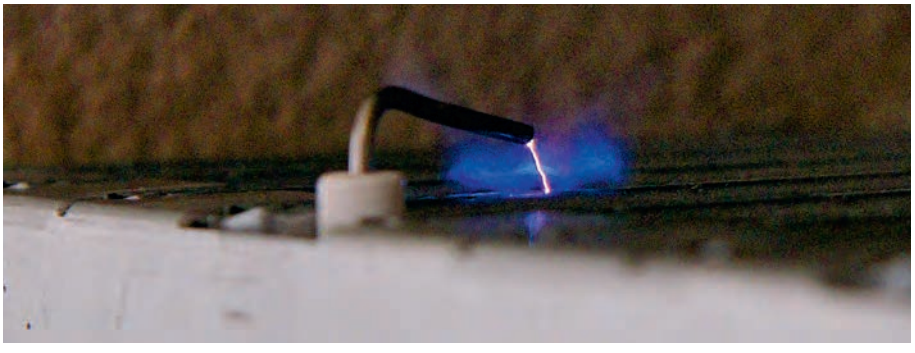
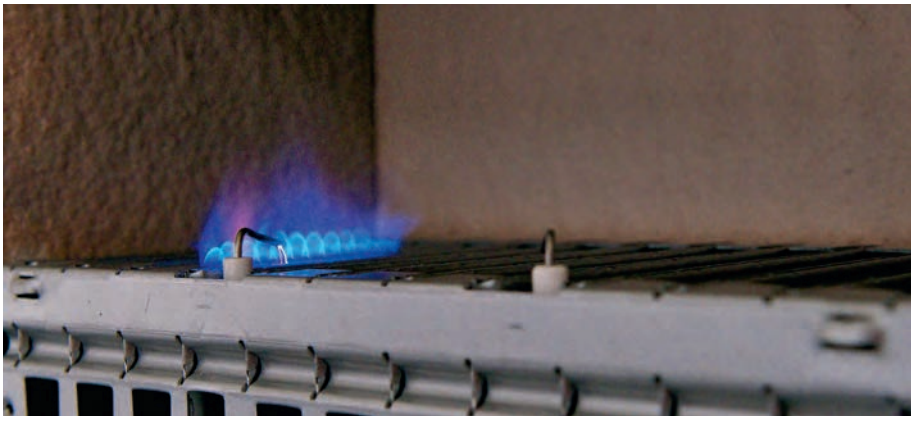


Pilot ignition on a flame rectification system



Flame rectification systems operate on the principle that a flame can conduct and rectify a small electric current

There is a probe attached to the burner that transmits a current from the control box, creating a spark and in turn causing a flame on the burner to light.



The current is then conducted by the flame and passes through it, becoming a half-wave rectified AC via the earth route of the metal mass of the burner. It then travels back to the control box where the solenoid valve is opened at the gas valve, allowing gas to flow to the burner. In this way the main flame is established.

Pressure differential valve

KEY POINT

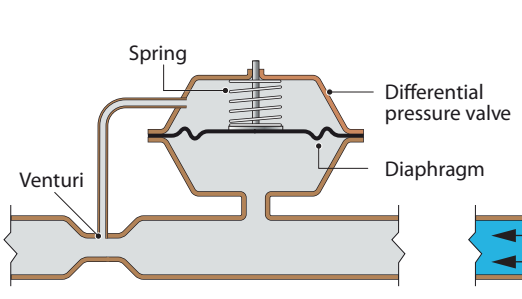
Diaphragms can split causing the process to fail, resulting in no or intermittent ignition.

Venturi principle

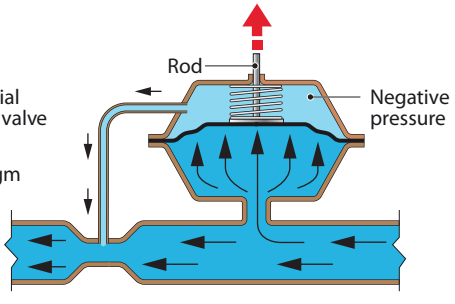
A Venturi operates on the principle that by reducing the bore of a water pipe for example, the flow of water will increase in velocity after that point. The process is similar to putting a finger over the end of a hose pipe or nipping the end of it which results in increased velocity.

Pressure differential valves

The image to the left is a pressure differential valve. It is found in instantaneous hot water heaters and combination boilers. It comprises a diaphragm with a rod connected to it which opens the flow of gas to a burner when the diaphragm rises and vice versa. The valve works on the **Venturi principle** and the integrity of the neoprene diaphragm is essential for efficient operation.



When there is no water flowing through the water pipe there will be equal pressure on both sides of the diaphragm and there will be no movement



When water flows, ie the hot water tap is turned on, the diaphragm will lift because the pressure is reduced at the top of the valve because of the negative pressure created at the Venturi. This is the differential pressure which creates the movement of the diaphragm within the valve

Pilot assembly with thermocouple and spark igniter

The image to the left shows a typical pilot assembly, located on the front of the boiler. On the left-hand side is a pilot tube, in the centre is the spark electrode and on the right-hand side is the thermocouple connection.

The image below it shows a section of the pilot assembly on the inside of an appliance, with the pilot shroud, the spark igniter and the thermocouple next to the burner.

Pilot flame enveloping the tip of a thermocouple

Rod-type thermostats

The principle of a rod-type thermostat is based on the coefficient of expansion between two dissimilar metals. The thermostat comprises

Gas-rating using metric meters

The meter displayed on the right shows 12.216 which means 12m^3 and 216 litres of gas have been consumed by the appliances connected to the system.

During a gas-rating test only a very small amount of gas will be measured over a two-minute period. Once the appliance reaches its operating temperature the meter reading is then confirmed and recorded while the appliance is working. After two minutes the reading is taken again. For example, if we take the meter reading of 12.216m^3/h in the first image as the first reading and 12.260m^3/h as the second reading after two minutes then the volume of gas can be calculated.

12.260m^3/h (2nd reading)
– 12.216m^3/h (1st reading)
= **00.044m^3/h** (volume of gas passed in 2 minutes)

Seconds in one hour

kW of energy produced by 1m^3 of gas (approx.)

Volume of gas passed after two minutes

$$\frac{0.044 \times 3600 \times 10.76}{120} = \mathbf{14.20kW}$$

The number of seconds in 2 minutes

kW consumed by appliance

Once the calculations are complete they can be compared with the manufacturer's instructions to assess if it they are acceptable. In the manufacturer's technical data permissible tolerances to any reading will be given.

In addition to gas rating many manufacturers require that a combustion analysis is carried out to confirm the efficiency of the appliance in accordance with their specifications.

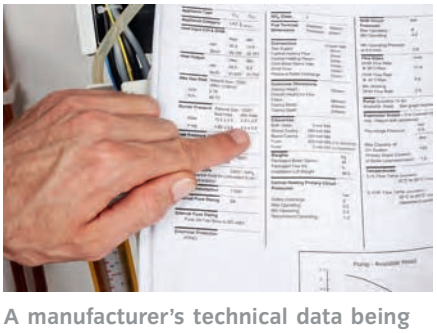
Gas-rating using imperial meters

An older-style domestic U6 imperial meter will pass the same maximum volume of gas per hour as its metric counterpart such as a G4 or E6 which is 6m^3. Instead of measuring m^3/h, on an imperial meter the volume is measured in cubic feet per hour (ft^3/h). Once the appliance has reached its operating temperature and the burner pressure is established, a reading can then be taken from the dial.

A metric meter

An imperial meter

A digital measurement display on a G4 meter



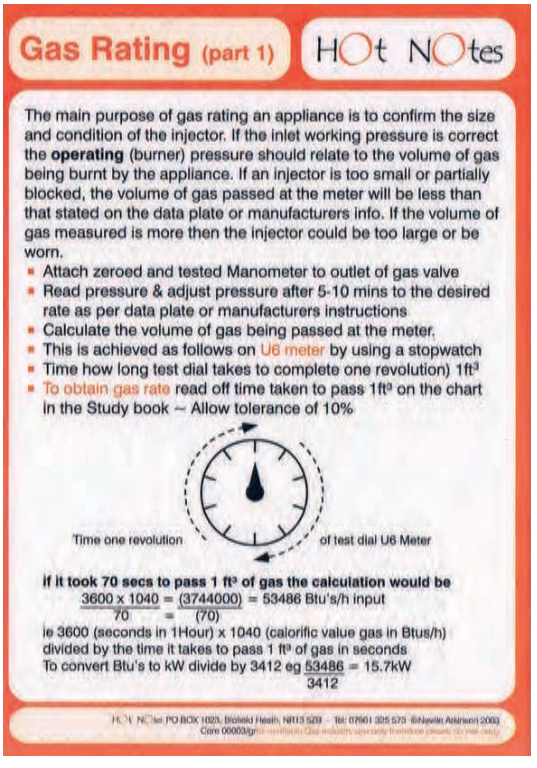
A manufacturer's technical data being used to assess the correct performance of an appliance

$$\frac{3600 \times 1040^{*}}{38} = \frac{3744000}{38} = 98526\text{BTU/h}$$

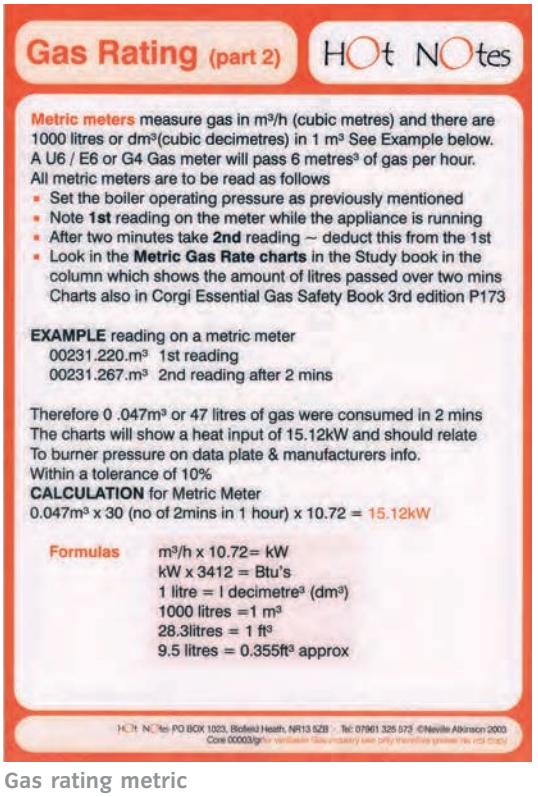
98526 ÷ 3412 = 28.87kW (gross)

28.87 ÷ 1.1 = **26kW net**

*1040 is the imperial CV of gas measured in BTUs.



Gas rating imperial



Gas rating metric

KEY POINT

When converting a value from gross to net, divide the figure by 1.11. When converting a figure from net to gross, multiply by 1.11.

Simple memory aids such as Hot Notes can help an engineer to recall essential processes during testing. Smaller concise information could be more convenient to the qualified engineer than taking out a larger manual to refer to when working on appliances.

Conclusion

This chapter is just an introduction to give you an awareness of the world of gas. Hopefully this learning will encourage you to pursue work experience opportunities with a registered Gas Safe company to gain your professional ACS qualifications in this specialist plumbing craft category.