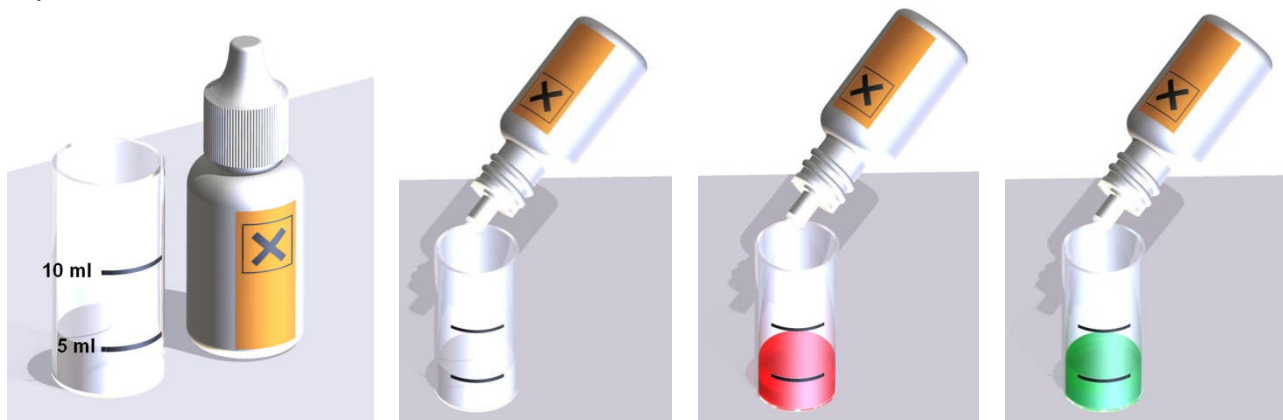


## How water hardness is measured

Measurement of water hardness is carried out by means of chemical reagents or strips of paper that assume a particular colouration depending on the hardness of the water; both methods are simple and safe. Below is an example of a test using chemical reagents. The kit consists of a measuring cup and a small vial containing reagent, in the package you will find two completely identical vials.

To run the test you must rinse the measuring cup several times with the water to be tested and fill up to the mark of 5 ml.



Add one drop of reagent and shake the measuring cup to mix completely, the water will turn red, add another drop and shake the cup again, count the drops that fill the measuring cup and continue until the red water changes colour and turns green, at this point the test is over. Each drop added to the cup will be equivalent to 2° f.

For example, if you have 13 drops of reagent needed to make green the solution, the water hardness is obtained using the following formula:  
 $13 \text{ (number of drops)} \times 2 \text{ (French degrees [}^\circ \text{ f]} \text{ of each drop of reagent)} = 26^\circ \text{ f}$   
(total hardness).

It is therefore very simple to determine the hardness of the water but you should always be careful as to what type of water hardness is being referred to. In fact, there are three kinds of hardness: total hardness, hardness and permanent the temporary hardness (also called carbonate hardness).

When you test for the hardness of the water, you should always pay attention to which of the three kinds of hardness is measured, which, to avoid misunderstanding, is always mentioned on the packaging or instructions attached. Furthermore, the colours that the water usually takes on can help distinguish the hardness measured. For example, when measuring the total water hardness the colouration is permanently red or green, while the reagents used to measure the carbonate hardness of water tinge with less permanent colours ranging from yellow to blue and generate effervescence. You must also verify that the unit of measurement used for detection of hardness, because some tests use French degrees [° f] while others use German degrees [° d]. If there is a K printed on the packaging, this means that the temporary hardness is to be measured and the unit of measurement used in this case is "grade calcium carbonate" (in German Karbonat).

Suppose we need to measure the hardness of a water sample with two tests, both in German degrees [° d]: the first finds the total hardness, while the second establishes the temporary hardness.

For example, the first indicator gives a result of 27°d and the second temporary hardness indicator gives a result of 15°d.

The total hardness is therefore 27°d, of which 15°d represents the temporary hardness, and therefore the remaining 12°d indicates the permanent water hardness. The equation reached is as follows:

$$\text{TOTAL HARDNESS} = \text{TEMPORARY HARDNESS} + \text{PERMANENT HARDNESS}$$

and therefore we can conclude:

$$\text{PERMANENT HARDNESS} = \text{TOTAL HARDNESS} - \text{TEMPORARY HARDNESS.}$$

Now suppose we measure the hardness of the same sample with two other tests, which this time uses French degrees [°f]: the first will detect the total hardness, whilst the second the temporary hardness. You will get the following results: the total hardness is equal to 48°f, while the temporary hardness (or carbonate) is 27°f.

As you can see, the same water sample has produced four different results because of two different units, therefore we can assume that 1°d = 1.79°f.

Therefore the total hardness is: 27°d x 1.79 = 48°f,  
whilst the temporary hardness will be 15°d x 1.79 = 27°f.

This example has been used in order to emphasise the difference between water softening and decarbonisation and to understand how important it is to know how to distinguish between the different types of hardness and relative units of measurement.



temporary hardness Kit [°d]  
Note : KH means Karbonat-Haerte  
(carbonate hardness = temporary hardness)



Total hardness Kit [°f]  
Note : GH means Gesamt-Haerte (total hardness)