Colour Deficiency

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**Colour Deficiency – What is it?**

The term “colour blindness” is often wrongly used to refer to people who are unable to distinguish colours.

In reality, a person suffering from “colour blindness” is able to see no colours at all, whereas the inability to determine, say, red from black is better referred to as “colour deficiency”.

According to US statistics this occurs more frequently in males than females and can affect around 8% of the adult population.

In the UK this means there are around 2.7 million people with Colour Vision Deficiency (CVD), most of whom are men.

A “red/green” deficiency is the most common – an inability to distinguish these two colours from one another – although various other deficiencies have been recorded.
**Colour Deficiency – Where does it come from?**

Colour deficiency is generally an inherited characteristic, however can also be brought on due to other medical conditions or even certain medicines.

Certain antibiotics, barbiturates, high blood pressure medication and even sildenafil (present in Viagra) have all been recorded as potentially having the side effect of affecting an individuals ability to see certain colours.

Alzheimers disease, diabetes, glaucoma, leukaemia, liver disease and a variety of other degenerative diseases also present this side effect. A gradual “washing out” of a colours hue can also be a sign of cataracts developing.

Certain industrial chemicals or by-products (Carbon monoxide, carbon disulphide and certain lead-based solutions) have also been known to cause this effect, alongside accidents or strokes that affect the brain/eye connection.

In addition certain individuals have experienced the natural on-set of colour deficiency due to physical changes that can occur around the age of 60.

In general, those with an inherited colour deficiency have a "stable" inability to perceive certain colours. Most people with an acquired colour deficiency, however, may still be able to process the majority of colours but the cause of the on-set can determine how severe the “blending” of colours is perceived as well as how quickly symptoms can deteriorate.


Colour Deficiency – What causes it?

Biologically-speaking, our vision is perceived though the eye via two different types of receptors.

“Rods” help us determine light and shade and “Cones” help to distinguish colour. Of the cones we have three types – long wavelength, medium wavelength and short wavelength. These register light in the yellow/green spectrum, the green part and the violet part respectively.

Colour deficiency occurs when an individual either has a decreased number of cones active in their eye, or faults in the type of cones that are present.

Genetically, the inherited characteristic of colour deficiency is passed via a faulty “X” gene.

Because of the way in which our chromosomes are matched this means that if an individual has an inherited colour blindness their mother must either be a carrier or have colour deficiency also.

Fathers can only pass the gene onto their daughters, who – because they have 2 X chromosomes - can only have the deficiency active in themselves if their mother is also a carrier. Sons, however, have a higher chance of inheriting the gene (as they only have 1 X chromosome).
**Colour Deficiency – Types**

Most people with CVD are able to see objects as clearly as other people but are unable to correctly see red, green or blue light.

The most common form of CVD is red/green deficiency – or Deuteranopia. Here, Deuteranopes are unable to process the colour green at all, with limited perception of red. People with deuteranopia do not mix up red and green but are unable to correctly see any colour which has red or green as a part (for example purple).

Someone with Tritanopia has a yellow/blue colour deficiency and again is unable to correctly "see" colours containing blue or yellow.

A different type of red/green deficiency is Protanopia. With this type, people are unable to perceive the colour red with limited perception of green.
**Colour Deficiency – The effects**

Statistically speaking, people with any type of CVD are only able to correctly identify 5 coloured pencils from a box of 24.

It's clear that the loss of these obvious distinctions can have repercussions within a variety of everyday activities.

People with CVD have reported issues with cooking, particularly when it comes to differentiating ripe and unripe food. In addition, determining whether food is properly cooked or still raw can be an obstacle to somebody with CVD. Food can also appear unappealing due to the similar colours present on a plate.

During education it can be difficult for people with CVD to join in with colouring activities or to easily read certain texts or differentiate images if written or drawn in some colours.

As an adult, driving can prove to be a challenge with CVD. Traffic lights, warning signs and other visual stimulus can be missed or misinterpreted if the correct colours are not visible.

Many electrical items that use red or green standby or charging lights can be confusing to someone with CVD and many businesses fail to take into account that the documents or presentations they produce may not be correctly interpreted by up to 8% of the population due to the colours used.
Colour Deficiency – Employment

In the UK, CVD is not classified as a disability. In Japan and many eastern countries however it is viewed as a defect and people with CVD may be excluded from certain careers or even prevented from driving.

Evidently there are some areas of industry or military organisations where it may be inappropriate for someone with CVD to work and industrial legislation also exists to force employers to account for people with CVD for safety reasons. Most people are able to work normally, possibly with limited assistance, in any other position.

In regards to recruitment there are various tests that can be undertaken to determine whether someone has CVD and, if so, how extensive the deficiency is.

The Ishihara test is a “Pseudoisochromatic” test which comprises a series of coloured dots that make up numbers, to be read aloud by a candidate. These dots are mixed into different colours (with occasional blank dots to act as control tests) that should make the numbers difficult or impossible to read if a candidate has CVD.

In addition to this, the Farnsworth D15 test can be used. This can take the form of an “arrangement” test which requires the candidate to place coloured discs in the correct order.

A Lantern test can also be used which replicates signals and requires the candidate to identify the colours of each.

From these tests an organisation should have objective data to determine whether or not an individual meets the standard for the specific role.

Within OFRS our policy on Colour Vision Deficiency limits state that;

“Mild green colour blindness is permitted. Red colour blindness is excluded. Management may wish to consider whether this is justifiable or defensible. Those driving LGV or PSV do not have to take a colour vision test.”

These tests – the Ishihara and the Farnsworth test – are carried out by the Occupational Health department (PAM Assist) before a Basic Recruits course and during each firefighters 3 yearly medical.
Within OFRS specific policies exist for vision standards and colour deficiency. During recruitment tests, if an individual fails both the Ishihara and Farnsworth tests by making one or more “confusions” the cross the hue circle, they are gauged to be unsafe for safety critical work.

If they fail the Ishihara tests but pass the Farnsworth test they can be judged to be safe for non-operational roles and additional functional tests can be taken to determine if their specific level of CVD allows them to operate as a firefighter.

The reason for these tests is relatively simple; a firefighter needs to be able to differentiate blue/green airlines with black hoses, black oxygen cylinders with maroon acetylene ones and act upon red warning lights on various equipment.

The functional tests for those people identified as have some form of CVD take the following form:

<table>
<thead>
<tr>
<th>Tests</th>
<th>Pass / Fail</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 – Different coloured wires to include Red and Green</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 2 - BA Gauge whilst wearing a BA mask not under air</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 3 - BA Gauge whilst wearing a BA mask not under air whilst in low light conditions</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 4 - BA Gauge whilst wearing a BA mask not under air whilst in darkness</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 5 - BA Board identify the reset button for Rapid deployment.</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 6 - BA Board identify the reset button for Rapid deployment in low light conditions</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 7 - BA Board identify the reset button for Rapid deployment in darkness and artificial lighting</td>
<td>Pass / Fail</td>
<td>Comments</td>
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<tr>
<td>Test 8 – BA Board ability to read the scale</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 9 – BA Board ability to read the scale in low light conditions</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 10 – PRPS suit to identify the coloured lights.</td>
<td>Pass / Fail</td>
<td>Comments</td>
</tr>
<tr>
<td>Test 11 – PRPS suit to identify the coloured lights in low light conditions</td>
<td>Pass / Fail</td>
<td>Comments</td>
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