

Revisiting color vision standards and testing methods in various occupational groups

Dear Editor,

The inherent ability to discriminate various wavelengths of light waves and to perceive the differences in hue is labeled as color vision. This ability of *Homo sapiens* to distinguish colors differentiates them from other species.^[1]

Color vision defect is an X-linked disorder that causes difficulty in distinguishing colors in the red, green, yellow, and blue spectrum. The UK Health and Safety Executive advisory advises that certain occupations require normal color vision perception to meet the safety standards while performing the job or safety checks for quality of products.^[2] They proposed that among various occupational groups, the specific functional color vision requirement may vary, and therefore all these candidates must undergo functional color vision assessment

recommended for their occupational profile. Only a few of the developed countries are performing universal population screening for the early identification of affected children so that they can be counseled regarding future occupational options.^[3] This endeavor to curb the color blindness is missing in India. The color vision disorders are stationary and untreatable. Genetic counseling has played a big role in reducing the burden.

The article by Dr. Amithavikram R. Hathibelagal^[4] in the April 2021 issue of *IJO* is a great insight into color vision assessment for the Army, Navy, and Air Force candidates and provides excellent recommendations based on his analysis. This made us think deeply and go a step ahead in recollecting the color vision standards and testing methods in various occupational groups. Table 1 provides a detailed insight over the same. As very little is known about color vision standards in various occupational groups, we believe that this article will be helpful to all ophthalmologists, including residents and fellows, along with optometrists who deal with these patients on a day-to-day basis for formal counseling and choosing a career wisely.

Table 1: Color vision standards and testing methods in various occupational groups^[5]

Occupation	Standard	Testing Method	Acceptable standard for various occupation	Acceptable color vision standard based on the test
Armed Forces (Army, Navy, Air Force)	Safety check	Ishihara test, Martin Lantern test	Army and Navy CP1 - Color Perception-1: Pass Martin Lantern test at 6 months Air Force CP2 - Zero errors on Ishihara test CP3 - Pass Martin Lantern test at 1.5 months/read correctly plates 22-25 in Ishihara test	a. Ishihara test - 12 out of 14 red/green test plates should be correct (not including the demonstration plate) b. Martin Lantern test - Out of 9 color pairs, the test subject is asked to recognize minimum of two colors c. Cambridge color test - The normal limits for performance for first examination on the basic "Trivector" test are 100 (protan), 100 (deutan), and 150 (tritan). d. Nagel Anomaloscope - Patient must be able to classify and grade red and green colors e. Farnsworth-Munsell 100 hue test - The overall error score determines more or less the severity of color vision deficiency.
Medicine (doctors, pharmacists, and health care professionals)	Safety and quality check	Ishihara test, Cambridge color test, Nagel Anomaloscope	No minimum standard	
Engineering (Lab technology)	Safety and quality check	Ishihara test, Cambridge color test, Farnsworth-Munsell 100 hue test	Complete or partial color blindness, if an employee suffering from color blindness is posted or transferred into a category wherein color perception is necessary, his eyes will be reexamined for the same along with the examination for visual acuity	
Railways	Safety check	Ishihara test,	Must pass all the test for color vision	
Merchant Navy	Safety check	Ishihara test, Cambridge color test, Martin Lantern test	Color blind not permitted	
Civil aviation	Safety check	Ishihara test, Martin Lantern test, Cambridge color test	Must pass Ishihara test and confirm with Martin Lantern test to identify signal colors, red, green and white color lights	
Police and Fire service	Safety check	Ishihara test, Martin lantern test	Police - Monochromats are rejected. Mild anomalous trichromats are accepted and are treated as normal. Severe anomalous trichromats and dichromats are also accepted and should be instructed in coping strategies. Fire - Minor color vision defects are acceptable	

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Occupation	Standard	Testing Method	Acceptable standard for various occupation	Acceptable color vision standard based on the test
Navigation	Safety check	Ishihara test, Cambridge color test	Any failure to identify a colored signal or color code is likely to cause an operational error or accident	
Chemical analysis (Colors)	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Different color vision standards for different industries based on work tasks, machinery, and the working environment	
Color television and testing/ maintenance professionals	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Must pass Ishihara test/ Farnsworth-Munsell 100 hue test	
Fine art and color photography	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Electrical workers	Safety check	Ishihara test,	Perfect to good color vision	
Electrical engineering (hospital and technicians industry)	Safety check	Ishihara test,	Perfect to good color vision	
Color matching (textiles, paper, painting, and dyeing)	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Carpet industry (warpers, weavers)	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Horticulture	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Wood Industry (paper making)	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Transport workers	Safety check	Ishihara test	Perfect to good color vision	
Painting and coating	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Fiber and textile	Quality check	Ishihara test	Perfect to good color vision	
Biological, chemical, and geological sciences	Quality check	Ishihara test, Farnsworth-Munsell 100 hue test	Perfect to good color vision	
Printing, paper, and photographic processing	Quality check	Ishihara test	Perfect to good color vision	
Art, sculpture, photography, and industrial design	Quality check	Ishihara test	Perfect color vision	
Graphic designer	Quality and safety check	Ishihara test	Perfect to good color vision	
Chef	Quality check	Ishihara test	Perfect to good color vision	

Safety check - Minimum color vision standard required so that the person can perform all tasks safely and efficiently. Quality check - Minimum color vision standard required so that the product quality and work efficiency is not compromised. Perfect color vision - No defect of color vision. Good color vision - Deficiency of one any cone (red, green, blue)

Compliance with ethical standards

The article has not been submitted elsewhere for consideration of publication. The article complies with the ethical standards by the Declaration of Helsinki.

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