COLOR MEASUREMENT AND CONTROL

HIGH VISIBILITY SAFETY APPAREL

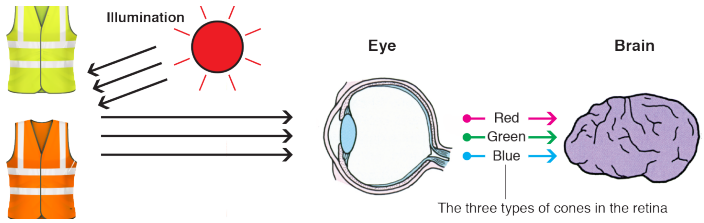
High-visibility safety apparel (HVSA) or high-visibility clothing (HVC) is a type of clothing or personal protective equipment. The type of clothing varies from vests, bibs to overalls that are worn, which has highly reflective properties or a color that is easily discernible from any background.

HVSA is worn by workers, safety personnel or law enforcers to improve how well other people see them (their visibility). Often, HVSA is worn to alert drivers or vehicle operators of a person's presence via high reflective material of the HVSA, especially in low light and dark conditions. HV headwear can also be worn to increase the visibility of a person in situations where parts or all of the person's body is obscured by obstacles like trees, barriers, construction materials or etc.

HVSA is needed if you are working in low lighting and poor visibility environment. It is a must if you are working around moving vehicles like cars, trucks or other machinery (e.g. forklifts, backhoes and etc.). HVSA allows a person to be seen by the operators of machineries more visibly and this increases work safety.

The human eye responds best to large, contrasting, bright or moving objects and visibility is enhanced by high color contrast between clothing and the work environment against which it is seen.

Measurement and Color Analysis



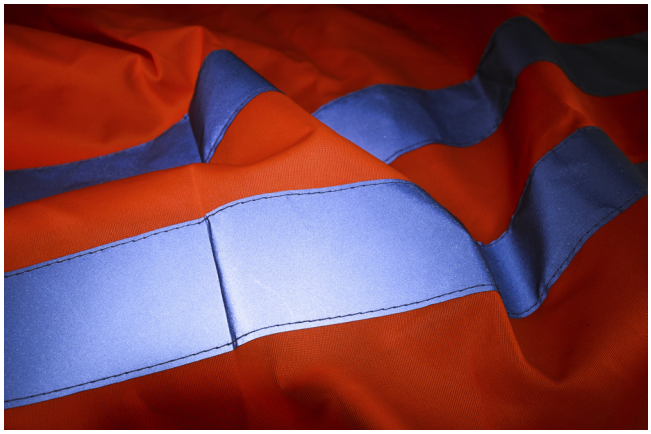
HVSA is made from fluorescent and retroreflective materials, the apparels have to be certified and qualified before use in the field, this certification is to ensure that the fluorescent and retroreflective material used is of high visibility, and it has good contrast for differentiating between obstacles and human being. There are four main colors used in HVSA garments, they are red, orange, yellow and yellow-green.

Fluorescence Material

Fluorescence is a chemical that is used in fluorescent materials, fluorescence absorbs invisible ultraviolet light from a light source and re-emits it back as visible light. Fluorescent material will appear brighter than the same colored non-fluorescent material, especially under low ambient light. This property offers and enhances daytime visibility not present with other colors, especially at dawn and dusk. Fluorescent colors provide the greatest contrast against most backgrounds.

Retroreflective Material

Retroreflective material is a type of material that reflects light in the direction of the light's source. This property allows light to reflect from the retroreflective material on a person's garment back in the direction the light is shining from, so long as retroreflective material is in the light's beam. It is effective under low-light level conditions. In daylight, there is little difference between the light reflected from the garment's material and the surrounding environment, this lack of contrast makes it ineffective for enhanced visibility during bright daytime conditions. Certain retroreflective material may also have fluorescent material in it. The standard used for the HVSA is the 'EN ISO 20471'.



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The standard is intended specifically for work wear high-visibility clothing, it does not support sport clothing or leisure activity. The standard is not to be applied to conventional work wear, which may feature a small amount of high visibility material used for either decorative or colour coded purposes. The standard is classified into three basic design class system (Class 1, Class 2 and Class 3) and two levels for retroreflectivity garments (Level 1 and Level 2), which is based on minimum areas of visible high-visibility materials present in a garment that make the wearer more conspicuous and is designed in a work wear manner.

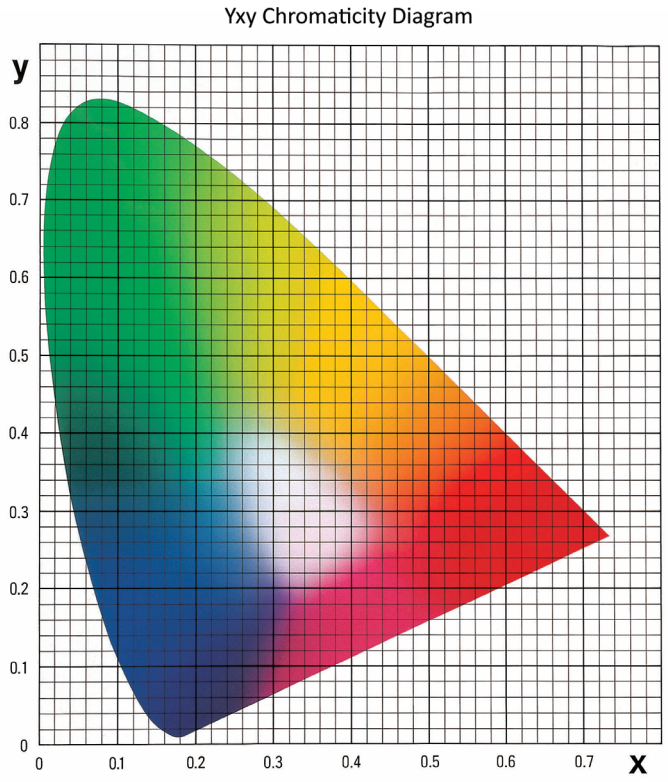
The three classes are based on general body coverage design of a garment. Each class has its own specified area of coverage from the torso (waist to neck) and/or limbs according to the minimum body coverage areas specified. The garments range from vest, tabards and other items that cover the torso, jackets, shirts, coats and t-shirts.

- Class 1 - Apparel consists of a basic harness or stripes/bands over the shoulder(s) and encircling the waist.

- Class 2 - Provides wearer with more visibility than Class 1. Apparel has full coverage of the upper torso (front, back, sides, and over the shoulders) and includes bib-style overalls. Stripes/bands are composed of retroreflective or combined performance materials

- Class 3 - Provides the greatest visibility for the wearer under poor light conditions and at great distances. Apparel meets the same requirements as Class 2 with the addition of bands around both arms and legs.

To comply with the standard, there is a measurement condition which is required. The color of the apparel has to be specified and measured based on the specified color. To perform the color measurement, a colorimeter has to be used, this is to quantify and qualify the color of the garment based on the parameters of the standard. The specification of the color instrument used has to be a 45°/0° geometry colorimeter. The condition measured is under the CIE illuminant D65 condition. The illuminant D65 corresponds roughly to a midday sun, hence it is also called a daylight illuminant. The parameters to qualify the HVSA are 'luminance Factor ßmin', 'CIE L*a*b*' and 'CIE Yxy color coordinates'. In the industry, an average measurement of 4 to 5 times is done and the average data is used for manufacturers to qualify the garment against the standards.



Konica Minolta offers a wide range of meters for quantifying color. For more information on color measuring instruments, please visit our Konica Minolta website at http://sensing.konicaminolta.asia.

Alternatively, you can email to us at ssg@gcp.konicaminolta.com for a free copy of 'Precise Color Communication' educational booklet or contact us at +65 6895 8685 to find out more about our products and services.

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