| Hyster-Yale Group, Inc. | Document Control Number: |
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| **Title:** BLACK COLOR | **HCE-148** |
| **Page 1** of **5** **Document Author:** Bob Downey | **Effective Date:** 01-Jan-2016 **Revision No.** 2016-01 |



**OBJECTIVE:** To provide a master color standard for “BLACK,” and to define the method for measuring “BLACK” for HYG product.

**SCOPE:** This color standard is independent of medium (paint, plastic, etc.). All medium-dependent color standards for “BLACK” are to reference this master standard.

If a medium-dependent standard does not exist for a particular medium, the drawing is to reference this color standard, and specify the appropriate gloss and/or texture.

Gloss and texture are not specified in this specification. Gloss and texture may have a significant impact on the appearance of the color. Therefore, gloss and/or texture must be specified in the medium-dependent specification, or on the part/chart drawing.

**CITED:** HCE-51, Black Paint (Gloss 20 +/- 5 @ 60 Degrees)
K207, Labels

**GENERAL:** There are two parts to this standard:

Part 1. Color Panels Defined

Part 2. Color Matching

**TRANSITION TO THIS STANDARD:**

New Drawings

- If a medium standard exists, (for example, HCE-51 black paint) the medium standard should be referenced, not HCE-148.
- If a medium standard does NOT exist, the drawing should reference HCE-148 for color, and the gloss/texture should be specified on the drawing as follows:

  See Method of Specifying

Existing Drawings

- It is not necessary to update existing drawings to specify HCE-148. However, existing drawings may be updated at the discretion of the designer.

## Part 1 – Color Panels Defined

**MASTER STANDARD:** The "black" color is defined by the **master standard**, which is located in the Portland Global Engineering file. See below for working standards.

Note: The following measurements (see Table 1) are from the master color standard, and were made with a Datacolor International Spectraflash SF600 PLUS-CT. They were measured under a Large Area View, specular included setting, with D65 illuminant and 10 degree observer. They should be used for reference, since different spectrophotometers give slightly different measurements for the same sample.

Table 1
Reflectance Values

| nm | %R | nm | %R | nm | %R | nm | %R |
|---|---|---|---|---|---|---|---|
| 400 | 4.93 | 480 | 4.81 | 560 | 4.76 | 640 | 4.70 |
| 410 | 4.91 | 490 | 4.81 | 570 | 4.75 | 650 | 4.68 |
| 420 | 4.90 | 500 | 4.79 | 580 | 4.74 | 660 | 4.66 |
| 430 | 4.88 | 510 | 4.80 | 590 | 4.73 | 670 | 4.66 |
| 440 | 4.87 | 520 | 4.79 | 600 | 4.74 | 680 | 4.67 |
| 450 | 4.85 | 530 | 4.77 | 610 | 4.73 | 690 | 4.64 |
| 460 | 4.85 | 540 | 4.77 | 620 | 4.73 | 700 | 4.66 |
| 470 | 4.82 | 550 | 4.78 | 630 | 4.71 | | |

**WORKING STANDARDS:** Working standards are color control panels that match the **master standard** within the following tolerance (see Table 2):

Color measurements are to be made independent of gloss or texture, with a spectrophotometer set to specular included.

Table 2
Working Standard Tolerances

| Illuminant | Observer Angle (deg.) | Delta E CMC (Max.) (l:c = 2:1) | Spectrophotometer |
|---|---|---|---|
| D65 | 10 | 0.25 | Specular Included |
| A | 10 | 0.25 | Specular Included |
| F2 | 10 | 0.25 | Specular Included |

Working standard color control panels are available from Global Engineering, Portland, Oregon.

## Part 2 – Color Matching

**MATCHING COLOR ON FINISHED PRODUCT:**

The color of finished parts is to match working standards (color panels [available from Global Engineering, Portland]), within the specified tolerance, using the measurement system described below.

CMC is used as the color tolerancing system for this standard. The lightness:chroma (l:c) ratio is 2:1. The CMC tolerance range is ellipsoidal. Ellipsoidal tolerance ranges better approximate what the human eye sees than non-ellipsoidal tolerance ranges.

Color measurements are to be made with a spectrophotometer that gives specular included measurements. "Specular included" means that the gage measures color without regard to the gloss or texture.

**DEFAULT TOLERANCE:**

The color of the finished part must match the color of the color control panel (working standard) within the tolerance shown (see Table 3) **unless otherwise specified in the medium specification or on the drawing**.

Table 3
Default Color Tolerance

| Illuminant | Observer Angle (deg.) | Delta E CMC (Max.) (l:c = 2:1) | Spectrophotometer |
|---|---|---|---|
| D65 | 10 | 1.00 (1) | Specular Included |
| A | 10 | 1.00 (1) | Specular Included |

(1) Color for Labels (reference K207): For individual labels, a color may vary 3.00 Delta E Max. from the color control panel (working standard). Within a given label the same color may not vary by more than 1.00 Delta E.

More Restrictive Color Tolerance

Only when necessary to meet design requirements, color tolerance can be more strictly controlled by requiring color match with a third illuminant such as F2 (see Table 4). **A more restrictive tolerance can significantly increase the cost of matching the color.**

Table 4
Additional Illuminant - Color Tolerance

| Illuminant | Observer Angle (deg.) | Delta E CMC (Max.) (l:c = 2:1) | Spectrophotometer |
|---|---|---|---|
| F2 | 10 | 1.00 | Specular Included |

Less Restrictive Color Tolerance

A less restrictive tolerance (for example, larger Delta E value) may be appropriate when the color match of a part does not negatively impact the cosmetic appearance of the product.

**GLOSS / TEXTURE:** Gloss / texture can significantly impact the apparent color of a part. Therefore, gloss or texture must be specified.

For painted parts, the gloss is specified in the paint specification. For plastic, fiberglass, etc., parts, the gloss / texture is specified on the drawing.

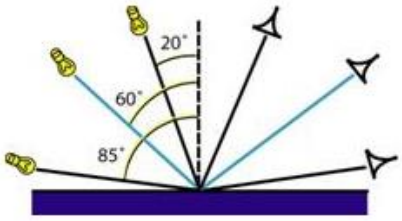
Gloss

When gloss is specified, the gloss level (0-100 for dull-glossy) and the reference measurement angle (see Figure 1) must be specified. Some examples include:

GLOSS 60 MINIMUM @ 20 DEGREES
GLOSS 60 +/- 5 @ 60 DEGREES
GLOSS 35-45 @ 60 DEGREES

Note: It is recommended that the supplier be consulted when specifying gloss / texture for plastic, fiberglass, etc., media.

Figure 1
Reference Measurement Angle




Texture

When texture is specified, the texture name and number is specified. For example:

TEXTURE: MOLD-TECH 11300

**MATCHING COLOR FOR MEDIUM SUPPLIERS:** Suppliers who provide paint, and other color media are to obtain a master color standard from Global Engineering in order to establish the color of their product. Master color panels must be returned to Global Engineering.

The suppliers' product, when applied to the finished part, must comply with the Default Tolerance (see Table 3) described in this specification.

**METHOD OF SPECIFYING:**

HCE-148 BLACK
Gloss and/or texture must be specified.
*Color Tolerance is only specified when different than the “default tolerance” above.

Examples:

HCE-148 BLACK
GLOSS XX +/- XX AT XX DEGREES
DELTA E XX MAX. PER HCE-148 (see note*)

HCE-148 BLACK
TEXTURE: (name) (number)
DELTA E XX MAX. PER HCE-148