Hyster-Yale Group, Inc.	Document Control Number:
Title: PAINT / FINISH AND PLASTIC FUNCTIONAL REQUIREMENTS	**HCE-145**
Page 1 of **5** **Document Author:** Bob Downey / Barry Stewart	**Effective Date:** 12-May-2016 **Revision No.** 2016-05

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OBJECTIVE: To provide test requirements that apply to paint / finish and plastic.

SCOPE: This specification applies to paint / finishes applied to HYG product and certain plastics used by HYG.

CITED: See Master Index for a complete list of Citing & Cited Documents.

REQUIREMENTS: The following requirements apply unless otherwise specified in the paint specification or on the drawing.

Painted / Finished Only

Steel test panels conforming to ASTM D609, Method A - Type 3 (iron phosphate conversion coating) shall be used. Panels are commercially available in a variety of sizes. The test panels shall be painted and cured in accordance with the coating process before proceeding with any of the tests.

Painted / Finished and Plastic

Paint / finish and plastic parts shall be free of lead, chromate, cadmium and other known toxic materials.

Functional Requirements

Except where specified, the test panels shall not show signs of color change, loss of adhesion (for paint / finish), streaking, softening, flaking, blistering, checking, chalking after completion of the following tests:

Steam

The paint film / plastic surface shall withstand a 90 second steam blast 0.41 MPa at 115ºC (60 PSI at 240ºF) hitting the surface at 90º from a 12.7 mm (0.50 inch) diameter nozzle 100 mm (4 inches) from the surface.

Water

With edges sealed in wax, there shall be no wrinkling, blistering or other film irregularity when a coated panel / plastic part is immersed in distilled water for eighteen hours at 25ºC (77ºF). After a 30 minute recovery period, no loss of gloss shall be evident. Some film softening may be noted. The original film hardness is to return after 24 hours of air drying.

Oil

The test panel shall be submerged in HCE-142 oil (or equivalent) at 93ºC (200ºF) for 200 hours.

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Gasoline

Immersion in regular gasoline for one hour at 21ºC (70ºF). After a 60 minute recovery period, a slight loss of gloss or color change is permitted. Some film softening may be noted.

Diesel

Immersion in No. 2 diesel fuel for 24 hours at 25ºC (77ºF).

Antifreeze

Test panel shall be submerged in a 44% aqueous solution of HCE-61 Ethylene Glycol Antifreeze at 93ºC (200ºF) for five minutes. A slight color change is permissible and the original film hardness shall return after 24 hours.

Film Flexibility

For paint / film only (not plastic parts), after suitable cure, the paint film shall exhibit a minimum elongation of 15% (corrected) per ASTM D522 Conical Bend Test.

Humidity Resistance

A panel with a scribe mark to bare metal shall be exposed to 100% relative humidity at 37ºC (98ºF) in a vertical position per ASTM D2247 for 168 hours. Film, after 30 minute recovery, shall not display blistering nor more than 20% loss of gloss, nor loss of integrity.

Salt Spray Resistance

For coated metal parts, after suitable cure, a diagonal scribe mark to bare metal shall be made across the side of the panel and then exposed to a 200 hour neutral salt spray test per ASTM B117 and ISO 9227. A minimum of three test panels shall be exposed.

The rust shall creep no more than 3.2 mm (0.125 inches) on either side of the scribe line. No field blistering is permitted.

Adhesion

For paint / finish, adhesion shall be measured per ASTM D 3359, method B with a minimum rating of 4B.

UV Resistance

Weatherometer test panels exposed in a Xenon Arc Weatherometer for 300 hours shall show no more than 20% loss of gloss after half the test period or no more than 40% loss of gloss at completion of the test. Gloss shall be measured using a 60 degree gloss meter.

Hardness

Hardness shall be determined by the use of standard grade lead pencils as produced by Eagle Pencil Company and identified as Eagle Turquoise. Expose 6.3 mm (0.25 inches) of lead from the pencil and grind end on 6/0 grit wet-or-dry paper at 90 degrees to the pencil axis. Hold pencil at 45 degrees to coating surface and push forward 12.7 mm (0.50 inches) using as much downward pressure as possible without breaking lead. The softest pencil to mark the surface shall be 3B or harder. (Reference ASTM D3363)

Paint Thickness

Paint thickness is not specified because it depends on the application process, chemistry, color and opacity of the paint. The proper film application thickness should be determined in conjunction with the coating supplier at each HYG and supplied part manufacturing location. Thickness as tested for this specification is to be documented by the paint manufacturer for each coating material and all functional tests required in this specification shall be performed with a maximum dry film thickness no greater than this value. Manufacturing locations are to document and control the confirmed thickness requirement in the applicable work instructions or control plans.

Corner or edge thickness is important to the overall coating performance and every effort should be made to address paint performance and uniformity of coating thickness in production applications.

Appearance

Paint appearance shall be in accordance with the below matrix. Production processes should be set up to control and confirm paint quality meets or exceeds these requirements. Any item of concern not specified in this matrix should be agreed upon with the responsible quality group and controlled in the appropriate process control plans and work instructions.

Zone definition (Zone A, B, C & D) and examples for how to apply to each part or area of the truck is specified in HCE-151. If questions regarding zone requirements for a specific part exist contact your local Quality representative for clarification.

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Paint Finish Criteria By Zone							
#	Confirmation Item			ZONE A	ZONE B	ZONE C	ZONE D
1	**Paint Inclusions** fisheye, porosity, bubble, blister or spatter on parent material Max Occurrences Per Component	Similar Color (Gray on Black)	ø ≤ 0.25mm	10 Max	12 Max	12 Max	N/A
			ø ≤ 0.5mm	8 Max	10 Max	10 Max	
			ø ≤ 1.0 mm	4 Max	6 Max	6 Max	
			ø ≤ 2.0mm	2 Max	4 Max	4 Max	
			ø ≤ 3.0mm	1 Max	2 Max	2 Max	
			ø ≤ 4.0mm	Not Allowed	1 Max	1 Max	
			ø ≤ 5.0mm	Not Allowed	Not Allowed	1 Max	
		Contrast Color (Gold on Black)	ø ≤ 0.25mm	6 Max	8 Max	8 Max	N/A
			ø ≤ 0.5mm	4 Max	6 Max	6 Max	
			ø ≤ 1.0 mm	2 Max	4 Max	4 Max	
			ø ≤ 2.0mm	1 Max	2 Max	2 Max	
			ø ≤ 3.0mm	Not Allowed	1 Max	1 Max	
2	**Over Spray**	Contrasting Color		Not Allowed			N/A
3	**Dry Spray**	Same Color		ø 25 mm	ø40 mm	ø50 mm	N/A
4	**Sharpness of Boundary**	Profile of line (two tone)		2 mm	2 mm	3 mm	N/A
5	**Scratch, Scrape or Blemish** Max Per Component	Similar Color		1mm x 25mm	2mm x 25mm	2mm x 40mm	N/A
		Contrast Color		1mm x 5mm	2mm x 5mm	2mm x 25mm	N/A
		Scratch Quantity		1 Max	2 Max	4 Max	N/A
		Base Metal Exposed		Not Allowed			
6	**Runs & Sags**	Area = L X W		5mm x 5mm	2mm x 25mm	4mm x 25mm	N/A
		Quantity in 300mmø Area		1	2	3	N/A
		Depth is critical in determining acceptance of runs & Sags (1.5mm depth Max)					
7	**Color Match**	Drawing Specification		Must Match			N/A
8	**Gloss**	Drawing Specification		Must Match			N/A
9	**Under Cure**	Tackiness or Printable		Not Allowed			
10	**Rust**			Not Allowed			
11	**Orange Peel (Ref.)**	ACT Panels		Range of #5 to #7 in Powder and Liquid			N/A
12	**Hide**	Achieve full hide of substrate or undercoat (corners, radius, etc…)		Complete Hide Required			N/A
13	**Metal Finish**	Swirl Marks / Grinding Marks Visible Thru Paint		Not Allowed		Per Quality Boundary only	N/A

Measurement method / Definition:

#3 Dry Spray: Spray paint that loses so much solvent that it becomes too dry to flow out over the surface. Dry Spray has a lower gloss than the normal surface.

#4 Sharpness of Boundary: Waviness of masked paint line on the final product (distance between min. & max peak)

#11 Orange Peel: An irregularity in the surface of the paint film resulting from the inability of paint to “level out” after being applied or cured. Orange peel occurs as a characteristically uneven or grainy surface to the eye, but usually feels smooth to the touch.

Area of Inspection: 61cm x 61cm (2’x2’) area of inspection is used to judge large components. Entire part is judged if smaller than the 61cm x 61cm area specified.

Clustering: Clustering of defects not allowed. Viewing area is 5cm (2”) diameter with max 2 defects or types of defects.

Annex
Cited Documents

ASTM D522: STANDARD TEST METHOD FOR LABORATORY DETERMINATION OF CREEP PROPERTIES OF FROZEN SOIL SAMPLES BY UNIAXIAL COMPRESSION

ASTM D 3359: STANDARD TEST METHODS FOR MEASURING ADHESION BY TAPE TEST

ASTM D3363: STANDARD TEST METHOD FOR FILM HARDNESS BY PENCIL TEST

ASTM D609: STANDARD PRACTICE FOR PREPARATION OF COLD-ROLLED STEEL PANELS FOR TESTING PAINT, VARNISH, CONVERSION COATINGS, AND RELATED COATING PRODUCTS

HCE-61: Antifreeze Ethylene Glycol

HCE-142: SPARK IGNITION (GASOLINE & LPG) ENGINE OIL

HCE-151: Fit and Finish Zones