

TT-I-558c
April 14, 1967
SUPERSEDING
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FEDERAL SPECIFICATION

INK, MARKING STENCIL, OPAQUE, FOR NONPOROUS SURFACES (METALS, GLASS, ETC.)

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE

1.1 This specification covers one type and one grade of opaque stencil ink for marking nonporous surfaces (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards, of the issues in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein:

Federal Specifications:

H-B-621—Brush, Stencil.
TT-E-485—Enamel, Semi-Gloss, Rust-Inhibiting.
TT-P-25—Primer Coating, Exterior (Undercoat for Wood, Ready-Mixed, White and Tints).
TT-R-251—Remover; Paint (Organic Solvent Type).
TT-T-291—Thinner; Paint, Volatile Spirits (Petroleum-Spirits).
UU-S-625—Stencilboard.
VV-G-101—Gasoline; Motor, United States Government.
PPP-C-96—Cans, Metal, 28 Gage and Lighter.
PPP-P-704—Pails: Shipping, Steel (1 Through 12 Gallon).

Federal Standards:

Fed. Std. No. 123—Marking for Domestic Shipment (Civilian Agencies).
Fed. Test Method Std. No. 141—Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing.
Fed. Std. No. 595—Colors.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105—Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129—Marking for Shipment and Storage.

FSC 7510

TT-I-558c

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publication. The following publication forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

Department of Health, Education and Welfare:
Federal Hazardous Substances Labeling Act.

(Application for copies should be addressed to the U.S. Department of Health, Education and Welfare, Food and Drug Administration, Washington, D.C. 20203.)

3. REQUIREMENTS

3.1 Pigment. The stencil marking ink shall be made from any pigmentation which will insure compliance with the requirements of this specification.

3.2 Vehicle. The vehicle shall be such as to produce a stencil ink conforming to the requirements of this specification. The solids shall be 20 percent minimum by weight of the vehicle.

3.3 Dry opacity (hiding power). Dried films of the inks applied at a wet-film thickness of 0.002 inch shall show the minimum contrast ratios indicated for the respective colors listed in table I. (See 4.4.1.)

TABLE I. Colors and contrast ratios

Color ¹	Minimum contract ratio
White	0.90
Black (No. 37038)	1.00
Gray (No. 36231)	1.00
Red (No. 31136)	0.80
Yellow (No. 33538)	0.92
Green (No. 34108)	1.00
Blue (Dark) (No. 35044)	1.00
Blue (Light) (No. 35109)	0.95
Orange (No. 32246)	0.95
Maroon (No. 30111)	1.00

¹ The numbers in parentheses are covered in Fed. Std. No. 595.

3.4 Colors. Colors of ink shall be as listed in table I, as specified (see 6.2). Colors furnished shall comply with Fed. Std. No. 595. (See 4.4.2.)

3.5 Storage stability. After 21 days standing, ink in a closed three-quarter-filled can shall show no skinning, livering, curdling, or color separation, and shall show no more settling than is easily and readily broken up and redispersed by stirring with a paddle by hand when tested as specified in 4.4.3.

3.6 Working properties. When tested as specified in 4.4.4, the ink as received shall be capable of being readily applied to clean metals, glass, and other nonporous surfaces by means of stencilboard conforming to UU-S-625. The ink shall be applied by a stencil brush conforming to H-B-621; by roller coater, and by spray.

3.7 Gloss. The ink shall dry on an impervious surface with a maximum gloss reading of 30 when tested as specified in 4.4.5.

3.8 Flexibility. A panel shall show no cracks when prepared and tested as specified in 4.4.6.

3.9 Miscibility. The ink shall be miscible with mineral spirits. (See 4.4.7.)

TT-I-558c

3.10 Performance. (See 4.4.8.)

3.10.1 Stenciling. Stenciling shall present legible characters of uniform boldness and general appearance. The ink shall not smear when rubbed lightly when tested as specified in 4.4.8.1.

3.10.2 Resistance to water. The stenciled lettering shall be legible, retain its characteristic color, not smear with vigorous rubbing, nor crack or peel when tested as specified in 4.4.8.1.1.

3.10.3 Resistance to gasoline. The stenciled lettering shall remain clear and sharp without streaking or blurring and shall show no appreciable color difference after drying 1 hour and after drying 24 hours when coated as specified in 4.4.8.1.2.

3.10.4 Resistance to light and water spray. Prepared panels shall show no cracking, checking, or flaking and not more than a slight change of color when tested as specified in 4.4.8.1.3.

3.11 Characteristics of nonvolatile vehicle. The film of the nonvolatile vehicle shall not powder or flake off when tested as specified in 4.4.9.

3.12 Prohibited ingredients. The product shall contain no benzol (benzene), aniline oil, chlorinated compounds, or other toxic or hydrolyzable chlorine derivatives. (See table IV.)

3.13 Harmful ingredients.

3.13.1 Effect on applicators. The ink shall contain no ingredients which have a deleterious effect upon the brushes, roller coater, and sprayer used in its application when tested as specified in 4.4.10.1.

3.13.2 Effect on brass. The ink shall not etch, corrode, stain, or discolor polished brass when tested as specified in 4.4.10.2.

3.14 Average net content. The average net content per unit container shall not be less than that specified or indicated. (See 4.3.1.2.)

3.15 Workmanship. The ink shall be in a homogeneous state and free from foreign matter. (See table III.)

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Certificates of compliance. Where certificates of compliance are submitted, the Government reserves the right to check test such items to determine the validity of the certification.

4.2 Inspection. Sampling for inspection shall be in accordance with the provisions of MIL-STD-105, except where otherwise indicated.

4.2.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected and tested in accordance with all the requirements of referenced specifications, drawings, and standards unless otherwise excluded, amended, or qualified in this specification or applicable purchase documents.

4.3 Inspection of the end item.

4.3.1 Examination of the end item. The end item shall be examined for the defects indicated in the following applicable subparagraphs and at the inspection levels and acceptable quality levels (AQL's) set forth in 4.3.1.4. The lot shall be expressed in ink-filled unit containers of the same capacity for examinations in 4.3.1.1, 4.3.1.2, and in units of shipping containers for examination of preparation for delivery under 4.3.1.3.

4.3.1.1 Examination of end item for visual defects. Examination of the end item shall be made for the visual defects listed in table II. The sample unit for this examination shall be one ink-filled unit container.

TT-I-558c

TABLE II. Examination of end item for visual defects

Examine	Defect
Container.	Not size, shape, type, or class of container specified, as applicable. Inner or outer seal not as required. Color not as specified. Interior and exterior coating, as applicable, not as specified. Any evidence of seepage or leakage from any part of the container including closure and seams. Closure not as specified. Not equipped with a spout, as applicable. Dented or distorted unit container.
Workmanship of ink.	Not homogeneous. Presence of foreign matter. Contains lumps, skins, curdling, livering, or caking.

4.3.1.2 Examination for average net content. The sample unit for this examination shall be one ink-filled unit container. The lot shall be unacceptable if the average net content per container for all sample units examined does not comply with 3.14. (See 4.3.1.4.)

4.3.1.3 Examination of preparation for delivery. Examination shall be made as indicated in table III to determine that markings, materials, and workmanship comply with the requirements of section 5 of this specification. The sample unit shall be one shipping container, fully packed, selected just prior to the closing operation. Closed shipping containers, fully prepared for delivery, shall be examined for closure defects. (See 4.3.1.4.)

TABLE III. Examination of preparation for delivery

Examine	Defect
Markings (interior and exterior).	Incorrect, incomplete, illegible, omitted; of improper size, sequence, or method of application; not in accordance with contractual requirements (see 5.3).
Material.	Any nonconforming component; component missing, damaged or otherwise defective.
Workmanship.	Inadequate application of components such as incomplete closure of container flaps and loose or inadequate sealing, strapping, or stapling. Bulged or distorted container.
Contents.	Number of unit containers is less than specified.

4.3.1.4 Inspection levels and AQL's for examination. The inspection levels and AQL's expressed in defects per 100 units shall be as follows:

Examination paragraph	Inspection level	AQL's
4.3.1.1	I	2.5
4.3.1.2	S-2	N.A.
4.3.1.3	S-1	

TT-I-558c

4.3.2 Testing of the end item. The methods of testing specified in Fed. Test Method Std. No. 141, where applicable, and as shown in table IV shall be followed for each lot. The sample unit for testing shall be 1 quart of ink. The lot size shall be expressed in quarts. The sample size shall be as specified hereinafter for the respective lot sizes. All test reports shall contain the individual values utilized in expressing the final result. The lot shall be unacceptable if one or more sample units fail to meet any test requirement specified.

<u>Lot size (quarts)</u>	<u>Sample size</u>
800 or less	2
801 up to and including 22,000	3
22,001 or more	5

4.4 Test procedures.

4.4.1 Dry opacity. The dry opacity shall be determined in accordance with method 4121 of Fed. Test Method Std. No. 141. Apply the ink to a flat hiding power chart, with a 0.002-inch Bird film applicator or other doctor blade that applies a wet film of 0.002-inch thickness; allow to dry and determine the contrast ratio.

4.4.2 Color. Comparison of the color of the sample ink with that of the specified color chip of Fed. Std. No. 595 is by visual inspection, conducted in the following manner: Apply a film of the sample ink at complete hiding to a nonporous panel and allow to dry completely. Place beside the standard of specified color chip and compare visually under illumination in accordance with method 4250 of Fed. Test Method Std. No. 141.

4.4.3 Storage stability. The storage stability shall be determined in accordance with method 3021 of Fed. Test Method Std. No. 141. For test use a three-fourths filled container. Examine after 21 days for skinning, curdling, and color separation. Test with a paddle to determine if any settled pigment is redispersed.

4.4.4 Working properties. Using stencilboard, apply the ink to the prepared panels (4.4.8.1) by marking with stencil brush, roller coater, and by spray. Observe whether the ink has satisfactory working properties.

4.4.5 Specular gloss. The gloss measurement shall be made according to method 6101 of Fed. Test Method Std. No. 141, in which case gloss reading shall be not over 30.

4.4.6 Flexibility. Determine by method 6221 of Fed. Test Method Std. No. 141. Coat flat panels with a 0.002-inch Bird film applicator or other doctor blade that applies a wet film of 0.002 inch. Let air-dry for 48 hours at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) and relative humidity of 50 ± 4 percent, and then bend over a $\frac{1}{4}$ -inch rod at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) Examine for cracking with the unaided eye (no magnification).

4.4.7 Miscibility. Mix one volume of the ink with one volume of mineral spirits conforming to TT-T-291, grade 1. Examine for evidence of curdling or precipitation.

4.4.8 Performance.

4.4.8.1 Stenciling. Using an ordinary stencil brush and stencilboard with letters approximately $\frac{3}{4}$ -inch high, stencil at least five letters, with a circular motion of the brush, on each of the following:

One primed wood panel coated with one coat of paint conforming to TT-P-25, and allowed to dry hard.

One smooth plate glass panel.

Two primed steel panels coated with one coat of enamel conforming to TT-E-185, and allowed to dry hard.

The panels shall be prepared at least 18 hours prior to use. Observe whether the sample shows satisfactory stenciling properties, taking into consideration the nature of the surface coated, and whether the film presents a generally satisfactory appearance, including legibility, uniformity, smoothness, and freedom from conspicuously ragged edges. Rub lettering lightly with fingers 15 minutes after stenciling and drying at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) to determine resistance to smearing.

TT-I-558c

TABLE IV. Instructions for testing of the end item

Characteristic	Specification reference		Requirements applicable to—		Number determinations per sample unit	Results reported as—		Inspection level	AQL
	Requirement	Test method	Individ. unit	Lot aver.		Pass or fail	Numerically to nearest		
Vehicle solids	3.2	4052-TT-P-141	X		Aver. of 2		0.1 percent		
Dry opacity	3.3	4.4.1	X		Aver. of 2		0.1 ratio		
Color	3.4	4.4.2	X		1	X			
Storage stability	3.5	4.4.3	X		1	X			
Working properties	3.6	4.4.4	X		1	X			
Gloss	3.7	4.4.5	X		1	X			
Flexibility	3.8	4.4.6	X		1	X			
Miscibility	3.9	4.4.7	X		1	X			
Stenciling (appearance and resistance to smearing)	3.10.1	4.4.8.1	X		1	X			
Resistance to water	3.10.2	4.4.8.1.1	X		1	X			
Resistance to gasoline	3.10.3	4.4.8.1.2	X		1	X			
Resistance to light and water spray	3.10.4	4.4.8.1.3	X		1	X			
Characteristics of nonvolatile vehicle	3.11	4.4.9	X		1	X			
Prohibited ingredients	3.12	(1)	X		1	X			
Effect on applicators	3.13.1	4.4.10.1	X		1	X			
Effect on brass	3.13.2	4.4.10.2	X		1	X			

Supplier shall furnish a certificate of compliance covering this requirement (see 4.1.1).

TT-I-558c

4.4.8.1.1 Resistance to water. One hour after stenciling (4.4.8.1), place one of the steel panels in distilled water at 70°F. for 4 hours. Remove from the water and air-dry 1 hour. Examine for legibility, color retention, cracking, and peeling. Note any tendency to smear when rubbed vigorously with the finger.

4.4.8.1.2 Resistance to gasoline. One hour after stenciling (4.4.8.1), wet one of the steel panels alternately with gasoline conforming to VV-G-101 and distilled water, five times for each liquid, allowing complete evaporation of each wetting. After 24 hours examine for any deleterious effects such as loss of clearness and sharpness; streaking, blurring, and any appreciable color change.

4.4.8.1.3 Resistance to light and water spray. Using a 0.003-inch Bird film applicator, or other doctor blade that applies a wet film of 0.003-inch thickness, apply the ink to prepared tin panels (method 2012.1). Allow the ink coating to air-dry at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) and relative humidity of 50 ± 4 percent for 24 hours. Then expose the coated panels in the apparatus described in either method 6151 or 6152 of Fed. Test Method Std. No. 141, using light and water spray for 100 hours. Examine the ink coating for checking, cracking, flaking, and change of color.

4.4.9 Characteristics of nonvolatile vehicle. Separate some of the vehicle by supercentrifuge (method 4032 of Fed. Test Method Std. No. 141), flow it on a clean tin panel (lightly buffed with steel wool) and allow to air-dry in a nearly vertical position at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) and relative humidity of 50 ± 4 percent for 18 hours, then bake at $105^{\circ} \pm 2^{\circ}\text{C}$. ($221^{\circ} \pm 4^{\circ}\text{F}$.) for 4 hours. Cool $\frac{1}{2}$ hour at room temperature and apply the knife blade test (method 6304.1 of Fed. Test Method Std. No. 141). Also scrape and cut across the film with the knife blade in various other ways to determine if there is any flaking or powdering off of the film.

4.4.10 Harmful ingredients.

4.4.10.1 Effect on applicators. After using the ink, clean the brushes, stenciling tools, and appliances in the customary manner, and then examine for harmful or damaging effect from the ink.

4.4.10.2 Effect on brass. Apply a liberal coat of the ink by brushing, or any other method, to a 2- by 2-inch brass panel which has been brightly polished and cleaned with solvent. Allow the ink to remain on the panel for 48 hours at $23^{\circ} \pm 1.1^{\circ}\text{C}$. ($73.5^{\circ} \pm 2^{\circ}\text{F}$.) and relative humidity of 50 ± 4 percent. Completely remove the ink by immersing the coated panel in paint remover conforming to TT-R-251 for 15 or 20 minutes. Wash off all the residual matter from the surface of the metal using a clean soft cloth and a suitable solvent (toluol for example). Avoid any abrasive action. Examine the metal for etching, corrosion, staining, and discoloration.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B, or C, as specified (see 5.2.2 (level B) and 6.2).

5.1.1 Level A. The ink shall be packaged in 1-pint, 1-quart, 1-gallon, and 5-gallon quantities, as specified (see 6.2).

5.1.1.1 One-pint, one-quart, and one-gallon quantities. The one-pint, one-quart, and one-gallon containers shall be round or oblong metal cans conforming to type V, class 4 with inner seal, exterior coating plan B of PPP-C-96. One-gallon cans shall be provided with either a wire handle or a formed bridge-type handle. The filled one-pint cans shall be packaged in accordance with the level A packaging requirements in the Appendix to PPP-C-96.

5.1.1.2 Five-gallon quantity. Five-gallons of the ink shall be packaged in a 5-gallon-capacity steel pail conforming to type I, class 3 of PPP-P-704. Each pail shall be provided with a push-pull spout and a screw-cap closure or a flexible spout closure. Either type closure shall be provided with an exterior seal.

5.1.2 Level C. The ink shall be packaged to afford adequate protection against damage during shipment from the supply source to the first receiving activity. The supplier may use his standard practice when it meets this requirement.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

TT-I-558c

5.2.1 Level A. One-pint, one-quart, and one-gallon filled cans of ink, packaged as specified in 5.1, shall be packed in accordance with the level A packing requirements in the Appendix to PPP-C-96. Five-gallon pails shall require no overpacking.

5.2.2 Level B. One-pint, one-quart, and one-gallon filled cans of ink, packaged as specified in 5.1, shall be packed in accordance with level B packing requirements in the Appendix to PPP-C-96. Five-gallon pails shall require no overpacking.

5.2.3 Level C. One-pint, one-quart, and one-gallon filled cans of ink, packaged as specified in 5.1, shall be packed in accordance with level B packing requirements in the Appendix to PPP-C-96. Five-gallon pails shall require no overpacking.

5.2.3 Level C. Ink, packaged as specified in 5.1, shall be packed in a manner to insure carrier acceptance and safe delivery at destination at the lowest transportation rate for such supplies. Containers shall be in accordance with rules or regulations of carriers applicable to the mode of transportation.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military requirements. In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

5.3.3 In addition to the marking specified in 5.3.1 and 5.3.2, each container shall be legibly marked in accordance with the Federal Hazardous Substances Labeling Act, and with the names of suitable solvents for use in thinning the ink to stenciling or spraying consistency.

6. NOTES

6.1 Intended use. The ink covered by this specification is a light and weather-resistant, fast-drying, flat-finish stencil ink for marking metals, glass, stone, and similar nonporous surfaces. It is intended primarily to be used with an ordinary wood-handle stencil brush and stencilboard. It may also be used with a hand-lettering brush or may be applied by spray or roller coater.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents (see 4.1 and 4.2.1):

- (a) Title, number, and date of this specification.
- (b) Color of ink required (see 3.4).
- (c) Quantity of ink required. (See section 5.)
- (d) Levels of packaging and packing required and any special marking desired (see 5.1, 5.2, and 5.3).

6.3 Weight. The stencil ink covered by this specification should be purchased by volume (231 cubic inches to the gallon). The weight per gallon varies with the color and with the manufacturer. For most of the colors except black, one gallon of the ink weighs about 10 pounds; black ink weighs about 7¼ pounds.

MILITARY CUSTODIANS:

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