

DATE OF ISSUE : 5/15/63

SUPERSEDES : 5/1/63

1. DESCRIPTION OF LINE:

(a) General Description

The 873-Line, "Lucite"* Acrylic Flat enamels. Thermoset, includes a complete range of solid, medium, and pastel colors for sale to the stripecoating industry. Although developed principally for the aluminum house siding industry the 873-Line quality may be used over treated aluminum substrates in other areas where a low gloss thermosetting acrylic type product is desired. This quality has a very good level of initial and retained knife adhesion, solvent resistance, overbake discoloration, and pressure mottling resistance. The 873-Line is based on a blend of acrylamide, alkyd, and epoxy resins and is intermediate between the 752-Line "Dulux"* enamel and the 805-Line "Imlar"* enamels in durability performance, particularly color retention.

All enamels in the 873-Line are currently formulated with polyethylene (3.0% of the binder) to provide excellent wear resistance. Gloss range is approximately 6 to 12 at 60° with a maximum of 18 at 85° unless otherwise specified.

Colors in this quality should be formulated at the lowest prime P/B level consistent with a previously determined level of hiding, (see suggested P/B levels for whites and colors discussed under the pigmentation section of this practice). For any products that are developed at less than the determined level of hiding due to cost reasons, etc. the formulator should obtain Sales approval prior to submission.

(b) References

Marshall Development Laboratory Release Letter No. 1950

2. APPLICATION AND TESTING

The 873-Line is intended to be applied by reverse rollercoating technique. Laboratory baking schedule for this quality is 70 seconds at 510° except where otherwise specified.

REMARK: PAR 13111: To correct reference from Release Letter No. 1975 to 1950

Supersedes: FP-873-1 dated 5/1/63

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When the quantity of color is small, it is recommended that the pigment be used as packaged without dilution. When quantities are large, a ratio of 30 to 40 is usually applicable on strip-making lines.

For testing purposes, color is often assigned to strip-making formulas. It is recommended that it may be necessary to adjust some colors to conform to customer specifications. It will be the responsibility of the formulating laboratory to include these modifications, additions, or deletions from SSP-119 in the individual formula involved. However, because of certain principles discussed later all colors in the S/L line should be matched instrumentally.

III. FORMULATION

(a) Pigmentation

(1) Introduction

This practice contains general formulating directions designed to assist the formulator in choosing the most durable pigmentation for developing colors in the 673-line quality.

If exact color matches to competitive products requested by Sales do not comply with the suggested durable pigments then it is the responsibility of the formulator to instruct Sales of this deficiency. A firm commitment should be obtained from Sales before proceeding with the development of exact color matches when a less durable pigmentation is required to match the color. Whenever possible Sales should be urged to convince the customer to accept the more durable pigmentation. In many cases the metameric condition produced by pigment differences is practically negligible however severe metamerism may result with certain colors.

GENERAL RECOMMENDATIONS FOR DEVELOPING THE PIGMENTATION OF A NEW COLOR

(1) Check the obsolete file to see if the color has been developed previously. If not, determine if it has been developed in other lines.

(2) If successful in (1) check the pigmentation versus the current active pigmentation in this practice. If the pigmentation is not according to the preferred practice or contains an excessive number of pigments; then redevelop as a new color. The same color number could be used if an exact color match is obtained.

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(3) If no previous satisfactory pigmentation is available, as expected with color matches to competitive products, then a new basic color development will be necessary. As a general guide the following procedure should be used.

(a) Make an approximate classification of the color i.e., dark gray, light green and medium blue, etc.

(b) Refer to the selected classified section of this pigmentation practice to determine the preferred formulating pigments.

(c) Shade with the principal colors, selecting the tinting pigments which will require the least shading to obtain the desired color. This will result in the simplest formula and generally the most durable.

(d) Repeat trial pigment combinations until it appears that a simple preferred combination will give the proper hue.

(e) Tone with the most preferred and least expensive tinting colors.

(f) When an approximate shade is obtained, calculate the pigment composition on a 100% basis.

(g) Determine whether the original color classification was correct under (a). If not redevelop in accordance with the proper color classification section.

(h) Each classified section is divided into a preferred and alternate allowable pigmentation, separated by the statement, "If the color can not be matched with the preceding pigment combinations, the following toning pigments may be used." All possible pigment combinations in the preferred section should be tried before using the alternate preference.

(i) When the final color match is obtained the pigmentation should be broken down to a 100% basis and rechecked against the pigmentation practice.

(j) All possible durable pigment combinations cannot be covered in a formulating practice. If the formulator believes that a combination of pigments outside the practice is durable it should be referred to the Marshall Laboratory for special consideration before using.

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(4) There are many common errors made in color development which result in excessive cost, inferior durability, and manufacturing difficulties. These errors generally result from a violation of one or more of the following basic formulating rules.

(a) Keep number of pigments to a minimum. Most colors can be developed with no more than two color pigments, black, and white.

(b) Do not blend complementary colors: Complementary colors, i.e., red and green when blended together result in black. A more durable and cheaper product results if a black pigment is used.

(c) Do not blend colors with complimentary undertones. A typical example of this malpractice is a blend of red-toned blue and blue toned green (W-519 and W-785). The resulting formula is excessively expensive.

(d) Do not use lightfast pigments to tone fugitive colors.

(5) Of course there are exceptions to the rules and procedures. To permit control and minimize the responsibility of individual formulators for field performance of new developments, it is recommended that formula development of a questionable composition be submitted to the Marshall Development Laboratory for review and approval.

(2) Pigment Blending Practice
Tinting Whites and Toning Blacks

The two pigments most common to all blends are white and black. There are two whites, W-123, Titanium Dioxide, and W-50 Titanium Dioxide; and two blacks, W-253, Peptized Carbon Black, and W-224, Carbon Black.

W-123, Rutile "Ti-Pure" R-900

This pigment is restricted to use in preparing white enamels only in the 873-Line quality.

W-50 Rutile "Ti-Pure" R-610

W-50 should be used in developing all colors in the 873-Line due to its excellent chalk resistance.

W-253, Unshaded Carbon Black

W-253 is to be used as the toning black in all colors and whites including light, medium, and dark gray enamels due to its excellent color drift stability.

W-224, Carbon Black

This pigment is restricted to the development of solid black enamels in the 873-Line. At times it may be necessary to use W-224 in the formulation of dark grays due to the high cost and weak tinting strength of W-253 or the impossibility of matching the color with W-253. In these extreme cases Sales should be advised of possible color drifting when W-224 is used.

Determination of Proper Flatting Base for Whites

There are two flatting bases developed for use in the 873-Line, quality as follows:

(a) 902-5001 based on a W-135/KG-8025 pigment combination which is to be used in the manufacture of all colors. 902-5001 should also be used to manufacture whites in which the "E" value is greater than 2 between an unshaded 873-Line white containing 902-5001 and the standard to be matched. It is important that the formulator adjusts the gloss to the customer's specifications before testing the feasibility of employing 902-5001. This particular flatting base is preferred because of its contribution to good physical properties such as impact adhesion, bend flexibility adhesion, and durability.

(b) 902-17927 based on a W-138/KG-8025 pigment combination imparts a higher initial reflectance to an unshaded 873-Line white but at a sacrifice in the above mentioned physical properties. However, in some instances due to very high initial reflectance of the white standard to be matched it will be necessary to use 902-17927 in place of 902-5001. It is the responsibility of the individual formulator to determine whether it is necessary to employ 902-17927. If the white standard cannot be matched satisfactorily with 902-17927 because of exceptionally high initial reflectance then the problem should be referred to the Marshall Development Laboratory.

USE OF W-679, CHROME YELLOW, IN 873-LINE WHITES AND COLORS

The vehicle composition employed in the 873-Line has a

slight but definite tendency to yellow on exterior exposure. The degree of yellowing that takes place is relatively precise, amounting to a total "E" change of approximately two units. This change occurs during the first six months exterior exposure or 600 hours AW-II exposure. Additional exposure does not result in increased yellowing. In the stripcoating industry nearly all whites and certain colors are shaded on the yellow side. A satisfactory system has been developed to counteract this vehicle yellowing by the use of a controlled amount of fugitive yellow pigmentation (W-679) in developing these enamels in the 873-Line quality. It is important that the W-679 not be used indiscriminately as a shading tool particularly since there are a wide range of whites, including high reflectance whites that require very little shading and low reflectance whites that require a substantial amount of tinting, i.e., more than an "E" of two units when measuring an unshaded white versus the color standard to be matched. The following procedure should be used as a guide by the formulator for matching whites in the 873-Line quality.

(a) High Reflectance Whites: Initially the formulator should check the total E color difference between an unshaded white in 873-Line quality, which has been adjusted to the customer's gloss requirements, versus the standard to be matched. See section of "Determination of Proper Flatting Base For Whites". For high reflectance white enamels based on 902-17927:

(1) If the "E" difference is less than 2 units then use only 902-679 if yellow is needed to match standard.

(2) If "E" is greater than 2 units and yellow is necessary then add 902-679 to effect a total E color change of approximately 2 units. The amount used should be recorded accurately in lbs., with a notation to be weighed in grams, and shown as an "on load" addition on the formula. For plant batches that vary in size the amount of 902-679 should be reallocated as any other principal ingredient in the formula. Any additional shading of yellow should be conducted with 902-630 or 902-608. IT IS IMPORTANT THAT THIS PROCEDURE BE FOLLOWED AT ALL TIMES.

(b) Low Reflectance Whites: For 873-Line whites, that due to the low initial reflectance of the standard being matched, can be prepared with 902-5001 the same procedure should be followed as indicated under (1) and (2) for "High Reflectance Whites".

(c) Colors: For medium and light grays, blues, and greens

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in the 873-Line quality requiring the addition of yellow pigmentation to produce a color match the following procedure should be employed:

(1) Add a minimum of 0.2 lb. of 902-679 but no more than 0.4 lb. per 100 gallon formula. As with the 873-Line whites the amount used should be shown as an "on load" addition on the formula with a notation to be weighed in grams.

(2) It is not necessary to determine any delta "E" change when applying this fugitive yellow technique to the above mentioned colors. The formulator should attempt to get the maximum amount of 902-679 (0.4 lb.) into the formula, however, if possible.

(3) If no yellow is required in making the color match then disregard (1) and (2).

(4) If additional yellow is needed (more than 0.4 lbs.) then use 902-608 or 902-630 for the additional shading.

ADDITIONAL DATA CONCERNING THE MANUFACTURE OF WHITES

(1) All 873-Line white enamels should be formulated at a 105/100 Prime TiO_2 P/B ratio using 902-17919 mill base.

(2) In addition to the requirements previously discussed concerning the proper flatting base and the use of W-679, chrome yellow, the following pigments may be used for toning white enamels.

Any amount of:

W-630, Ferrite Yellow
W-608, Sun Yellow
W-551, "Monastral"® Blue
W-750, "Monastral" Green
W-253, Carbon Black
W-362, Iron Oxide
W-819, "Monastral" Red
W-622, Molybdate Orange

PIGMENT BLENDING PRACTICE - COLORS

Probably the most difficult task for the individual formulator developing colors in the 873-Line quality is determining the proper prime P/B ratio. A relatively simple system has been

Reason for Issue: To delete KW-8237, Empress Yellow for Tinting
Supersedes: FP-873-7 dated 5/27/63.

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devised for this quality based on the "L" or reflectance value as determined by the Colormaster differential colorimeter. Although this method is not intended or expected to be absolute it should give the formulator a reasonably accurate way of controlling the prime P/B ratio in the various color ranges.

Minimum P/B ratios consistent with satisfactory hiding provide the most durable composition for exterior use in the 873-Line quality. The Marshall Laboratory has considerable exposure evidence to support this statement. However there is fairly good latitude for most color groups in setting the P/B ratio.

If the formulator has any doubt concerning the proper P/B ratio for any individual color the problem should be referred to the Marshall Laboratory.

The following pages in this practice referring to the development of individual types of colors indicate a range for the prime P/B ratio based on reflectance values. The following procedure should be used in determining the P/B ratio.

- (1) Classify the color by visual inspection, i.e., gray green, pink, buff, etc.
- (2) Measure the "G" value on the Colormaster differential colorimeter and then determine the "L" value of the Adams color coordinates system.
- (3) Refer to the classified section of this pigment blending practice where a range of prime P/B ratios based on "L" reflectance values has been set up for each type of color. The P/B ratios indicated are based on the total prime pigment (white and color components included)!!
- (4) If the formulator has any serious doubts concerning the development of a specific color the problem should be referred to the Marshall Development Laboratory.

PIGMENT BLENDING PRACTICE GRAYS:

Grays would be expected to be the simplest group of colors to formulate. However it is difficult in many cases to define the limits when a color ceases to be neutral and is classified as a green, blue, etc. As a guiding principle the formulator should formulate as a color rather than gray when in doubt as to the proper classification.

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In the formulation of all products except whites in the 873-Line quality the preferred TiO_2 pigment is W-50.

(A) Dark Grays

Dark grays are classified as neutral colors with a maximum $L = 45$ reflectance value. Grays that fall in this category should be formulated in a total prime P/B range of 20-25/100. If the "L" value is higher than 45 then the grays are formulated according to Section B or C.

W-253, Carbon Black, is the preferred pigment for formulating grays in this range and it may be toned with the following pigments:

- (1) W-50, Titanium Dioxide
- (2) W-630, Ferrite Yellow
- (3) W-362 Iron Oxide
- (4) W-551 "Monastral" Blue
- (5) W-750 "Monastral" Green

If the color cannot be matched with the preceding pigment combinations, the following toning pigments may be used.

- (6) W-608 Sun Yellow (expensive)
- (7) W-819 "Monastral" Red (expensive)
- (8) W-355 "Iron Oxide" (possible settling problems)

(B) Medium grays

Medium grays are classified as neutral colors with an "L" value range from 46 to 60. Grays that fall in this category should be formulated at a total prime P/B ratio equivalent to 70 per cent of the determined "L" value. If the reflectance value is less than 46 formulate according to Section A, if greater than 60, in accordance with Section C.

For medium grays the same toning pigments may be used as indicated under (A) Dark Grays.

IMPORTANT:

Refer to (C) under Use of W-679, Chrome Yellow, in 873-Line Whites and Colors for other specific instructions regarding manufacture of medium grays.

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Supersedes: FP-873-9 dated 5/27/63.

(C) Light Grays

Light Grays are classified as neutral colors with an "L" value greater than 60. Grays that fall in the range of 61 to 65 for the "L" value should be formulated at a prime P/B ratio equivalent to 80% of the determined "L" value. Grays with an "L" value greater than 65 should be formulated a total prime P/B ratio equal to the determined "L" value. If the reflectance value is less than L=61 then formulate according to Section A or B.

For light grays the same toning pigments may be used as indicated under Section A Dark Grays.

IMPORTANT:

Refer to (C) under Use of W-679, Chrome Yellow, in 873-Line Whites and Colors for other specific instructions regarding manufacture of light grays.

PIGMENT BLENDING PRACTICE

BLUES:

There are two principal blue pigments available as follows:

W-582, Milori Blue, is restricted to medium and dark blue tints due to its fugitive behavior in lighter tints. When W-582 is used Sales must be advised of its alkali spot sensitivity.

W-551, "Monastral" Blue, is a phthalocyanine type pigment which is completely lightfast and very clean but it is also considerably more expensive and weaker in tinting strength than Milori Blue. W-551 is the preferred pigment in medium to light blue colors.

NOTE: All blue colors containing more than 50% Iron Blue, W-582, require an added manufacturing cost to compensate for longer mixer tie-up. All formulas in this category will bear the following notation under Testing Information.

Caution: Contains Iron Blue

Color Drift: Wait 15 hours or longer after baking before comparing to standard for color.

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(A) Dark to Medium Blues:

Dark to medium blues in the 873-Line quality are classified as blue colors with a maximum L⁴⁰ reflectance value. Blues that fall in this category should be formulated at a total prime P/B ratio equivalent to 75 per cent of the determined "L" value. If the "L" value is higher than 40 then the blues are formulated according to Section B or C.

W-582, Milori Blue, is the preferred blue tinting pigment for formulating colors in this range and it may be toned with the following pigments:

- (1) W-50, Titanium Dioxide
- (2) W-253, Carbon Black
- (3) W-608, Sun Yellow (Expensive)
- (4) W-819, "Monastral" Red (Expensive)

If the color cannot be matched with the preceding pigment combinations, the following toning pigments may be used.

- (6) W-687, Predarkened Chrome Yellow (Fades)
- (7) W-551, "Monastral" Blue (Expensive)
- (8) W-750, "Monastral" Green (Expensive)

NOTE: Sales must be advised of alkali spot sensitivity if Milori Blue or Chrome Yellows are used.

(B) Medium to Light Blues:

Medium to light blues in the 873-Line quality are classified as blue colors with an "L" value range from 41 to 60. Blues that fall in this category should be formulated at a total prime P/B ratio equivalent to 80 per cent of the determined "L" value. If the reflectance value is less than 41 then formulate according to Section A, if greater than 60, in accordance with Section C.

W-551, "Monastral" blue, is the preferred tinting pigment for formulating colors in this range. However, it may be necessary in some cases at the lower end of the reflectance range to use some or all W-582 when an exact match is required to a customer standard. Sales should be advised if iron blue is used since colors in this range generally would be expected to exhibit only fair lightfastness when employing W-582.

Reason for Issue: To delete KW-8237, Empress Yellow for Tinting.
Supersedes: FP-873-11 dated 5/27/63.

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For lighter to light blues the same toning pigments may be used as indicated under (A) Dark to Medium Blues.

IMPORTANT:

Refer to (C) under Use of W-679, Chrome Yellow in 873-Line Whites and Colors for other specific instructions regarding manufacture of medium to light blues.

NOTE: Sales must be advised of alkali spot sensitivity of Milori Blue or Chrome Yellows are used.

(C) Light Blues:

Light blues are classified as blue colors with an "L" value greater than 60. Blues that fall in the range of 61 to 65 for the "L" value should be formulated at a prime P/B ratio equivalent to 80 percent of the determined "L" value. Blues with an "L" value greater than 65 should be formulated at a total prime P/B ratio equal to the determined "L" value. If the reflectance value is less than L = 61 formulate according to Section A or B.

W-551, "Monastral" Blue is the preferred pigment for formulating colors in this range.

For light blues the same toning pigments may be used as indicated under (A) Dark to Medium Blues. In addition the following pigments may be used:

- (1) W-352, Iron Oxide
- (2) W-630 Ferrite Yellow

IMPORTANT:

Refer to (C) under Use of W-679 Chrome Yellow, in 873-Line Whites and Colors for other specific instructions regarding manufacture of light blues.

PIGMENT BLENDING PRACTICE

GREENS:

There are two principal green pigments available as follows:

W-794, Chromium Green Oxide, is the preferred pigment for manufacture of all green colors in the 873-Line quality. The very fact

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that this pigment tends to chalk is beneficial in maintaining a green color. However, the use of W-754 is limited in that severe metamerism results if the standard to be matched contains other than W-754 as the principal green pigment. Every effort should be made through Sales to convince the customer to accept a slightly different color, if necessary, in order to employ W-754.

W-750, "Monastral" Green, is preferred if the color cannot be matched with W-754. As expected dark greens made with W-750 are expensive.

W-551, "Monastral" Blue, and W-608 Sun Yellow may be used to formulate greens only when they are needed to make an exact match. Sales should be advised that early chalk fading may result if this pigment combination is used.

W-582, Milori Blue and W-687, Predarkened Chrome Yellow, may be used to formulate solid greens only when an exact match is required to a competitive standard. Sales should be advised of darkening and alkali spot sensitivity.

(A) Dark Greens

Dark Greens in the 873-Line quality are classified as green colors with a maximum L = 40 reflectance value. Greens that fall in this category should be formulated at a total prime P/B ratio equivalent to 80% of the determined "L" value. If the "L" value is higher than 40 the greens are formulated according to Section B or C.

W-754, Chromium Green Oxide, is the preferred green tinting pigment for formulating colors in this range and it may be tinted with the following pigments:

- (1) W-50, Titanium Dioxide
- (2) W-253, Carbon Black
- (3) W-551, "Monastral" Blue (Expensive)
- (4) W-608, Sun Yellow (Expensive)

If the color cannot be matched with the preceding pigment combinations the following toning pigments may be used:

- (6) W-687, Chrome Yellow (Fades)
- (7) W-819, "Monastral" Red (Expensive)
- (8) W-630, Ferrite Yellow

Reason for Issue: To delete KW-8237 Empress Yellow for Tinting.
Supersedes: FP-873-13 dated 5/27/63.

The preceding area should be thoroughly investigated in an effort to obtain a satisfactory color match. If an exact match cannot be made Sales should be asked to review the possibility of customer acceptance of the slightly different but more durable color.

If it is not possible to make the dark green color with W-754 then W-750, "Monastrol" Green, is the preferred pigment and the same toning pigments may be used.

If the use of green pigments (W-754 and W-750) is not satisfactory then W-551/W-608 or W-582/W-687 combinations should be evaluated in the order given. The same toning pigments may be used as indicated with W-754.

NOTE: Sales must be advised of alkali spot sensitivity if Millori Blue or Chrome Yellow are used.

(B) Medium to Light Greens

Medium to light greens in the 873-Line quality are classified as green colors with an "L" value range from 41 to 60. Greens that fall in this category should be formulated at a total prime P/B ratio equivalent to 80 percent of the determined "L" value. If the reflectance value is less than 41 then formulate according to Section A, if greater than 60, in accordance with Section C.

W-754, Chromium Green Oxide, is the preferred green tinting pigment for formulating colors in this range. The same toning pigments may be used as indicated under (A) Dark Greens. If the color cannot be satisfactorily matched with this pigment then refer to initial statements under PIGMENT BLENDING PRACTICE - GREENS and Section (A) Dark Greens for alternate methods and secondary preferences for formulating green colors in the 873-Line quality. The formulator should make every effort through Sales to convince the customer to accept a slightly different color, if necessary, in order to employ the beneficial aspects of W-754.

IMPORTANT:

Refer to (C) under Use of W-679, Chrome Yellow, in 873-Line Whites and Colors for other specific instructions regarding manufacture of medium to light greens.

Light Greens

Light greens are classified as green colors with an "L" value greater than 50. Greens that fall in the range of 51 to 65 for the "L" value should be formulated at a prime P/B ratio equivalent to 80 percent of the determined "L" value. Greens with an "L" value greater than 65 should be formulated at a total prime P/B ratio equal to the determined "L" value. If the reflectance value is less than L = 61 formulate according to Section A or B.

W-754 is the preferred pigment for formulating green colors in this range. The same toning pigments may be used as indicated under (A), Dark Greens.

If the color cannot be matched satisfactorily with this combination then Sales should be requested to convince the customer to accept a slightly different color in order to employ W-754.

If it is not possible to use W-754 then the preferred green pigment is W-750, "Monastrol" Green.

IMPORTANT:

Refer to (C) under Use of W-679, Chrome Yellow, in 573-Line Whites and Colors for other specific instructions for manufacture of light greens.

PIGMENT BLENDING PRACTICE

BROWNS:

This section covers dark to medium brown colors that can be formulated with iron oxide and carbon black type pigments. Light brown, tans, creams, etc. are discussed in the next section.

(A) Dark Browns:

Dark browns are classified as brown colors with a maximum L = 45 reflectance value. Browns that fall in this category should be formulated in a total prime P/B range of 20 - 28/100. If the "L" value is greater than 45 then the browns are formulated according to Section B or C.

The following pigments are preferred in formulating dark brown colors:

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- (1) W-50, Titanium Dioxide
- (2) W-362 Light Kroma Red Iron Oxide
- (3) W-253 Carbon Black
- (4) W-630 Ferrite Yellow
- (5) W-355, Dark Kroma Red Iron Oxide

If the color cannot be matched with the preceding pigment combination the following toning pigments may be used:

- (6) W-622, Molybdate Orange (Fades)
- (7) W-608, Sun Yellow (Expensive)
- (8) W-819, "Monastral" Red (Expensive)

(B) Medium Browns:

Medium browns in the 873-Line quality are classified as brown colors with an "L" value range from 46 to 60. Browns that fall in this category should be formulated at a total prime P/B ratio equivalent to 75 per cent of the determined "L" value. If the "L" value is less than 46 then formulate according to Section (A), if greater than 60, in accordance with Section C.

The same preferred pigmentation should be applied to Section (B), as indicated under Section (A), for developing the medium brown colors in the 873-Line quality.

(C) Light Browns:

Refer to the section of this practice involving the formulation of creams, tans, ivories, and beiges which are all considered variations of light browns.

PIGMENT BLENDING PRACTICE:

CREAMS, IVORIES, BEIGES, TANS:

Tans, beiges, creams and ivories are classified as light browns with an "L" value greater than 60. Colors of this type that fall in the range of 61 to 65 for the "L" value should be formulated at a prime P/B ratio equivalent to 80 per cent of the determined "L" value. Colors with an "L" value greater than 65 should be formulated at a total prime P/B ratio equal to the determined "L" value. If the reflectance value is less than L = 61 formulate according to Section (A) or (B) under PIGMENT BLENDING PRACTICE BROWNS.

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The preferred pigments for formulating colors of this type are as follows:

- (1) W-50, Titanium Dioxide
- (2) W-630, Ferrite Yellow
- (3) W-253, Carbon Black
- (4) W-362, Light Kroma Red Iron Oxide
- (5) W-355, Dark Kroma Red Iron Oxide

If the color cannot be matched exactly with the preceding pigment combination the following toning pigments may also be used.

- (6) W-819, "Monastral" Red (Expensive)
- (7) W-608, Sun Yellow (if W-608 becomes the predominant color pigment then reformulate as a yellow).
- (8) W-750, "Monastral" Green
- (9) KW-8237, Empress Yellow (Expensive)

PIGMENT BLENDING PRACTICE

PASTEL ORANGES, CORALS, PINKS AND SALMONS

For cost and durability reasons the lightfast pastel oranges, corals, pinks and salmons should be formulated from W-50 Titanium Dioxide, W-362 and/or W-355 Red Iron Oxide and W-630, Ferrite Yellow.

Colors of this type are expected to have an "L" value greater than 60. If the "L" value is in the range of 61 to 65 then formulate the color at a prime P/B ratio equivalent to 80 per cent of the determined "L" value. If the "L" value is greater than 65 then formulate at a primer P/B ratio equal to the determined "L" value.

The preferred toning pigments for this color range are as follows:

- (1) W-50, Titanium Dioxide
- (2) W-630, Ferrite Yellow
- (3) W-362, Light Kroma Red Iron Oxide
- (4) W-355, Dark Kroma Red Iron Oxide
- (5) W-253, Carbon Black
- (6) W-819, "Monastral" Red (Expensive)
- (7) W-608, Sun Yellow (Expensive)

If the color cannot be matched with the preceding pigment combinations the following toning pigments may be used:

- (9) W-622, Molybdate Orange (Fades)
- (10) W-551, "Monastral" Blue, (Expensive)

Reason for Issue: To delete KW-8237 Empress Yellow for Tinting.
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PIGMENT BLENDING PRACTICEYELLOWS:

W-608, Sun Yellow, W-630, Ferrite Yellow are the preferred pigments for manufacture of all yellow colors in the 873-Line quality. The lightfastness of these pigments are excellent compared to the chrome yellow type pigments which are generally classified as fair for lightfastness. However, severe metamerism and/or difficulty in matching the brightness of clean competitive yellows prepared with chrome yellows may result. Every effort should be made through Sales to convince the customer to accept a slightly different color, if necessary, in order to employ W-608 and W-630.

W-687 and/or W-686, Chrome Yellows, may be used to formulate yellows only when an exact match is required to a competitive standard. Sales should be advised that early fading may result if these pigments are required. When it is necessary to use Chrome Yellows to obtain brightness the formulator should attempt to introduce as much W-608 and W-630 into the formulation as possible.

(A) Dark, Medium, and Light Yellows

Dark, medium, and light yellows are classified as yellow colors with an "L" value greater than 70. Yellows that fall in the range of 70 to 75 for the "L" value should be formulated at a total prime P/B ratio equal to the determined "L" value. Yellows with an "L" value from 76 to 80 should be formulated at a total prime P/B ratio equivalent to 110 per cent of the determined "L" value. Yellows with an "L" value greater than 80 should be formulated at a total prime P/B ratio of 105/100.

W-608, and W-630 are the preferred yellow pigments for formulating all yellows and they may be toned with the following pigments:

- (1) W-50 Titanium Dioxide
- (2) W-253, Carbon Black
- (3) W-750, "Monastral" Green (Expensive)
- (4) W-819, "Monastral" Red (Expensive)

The preceding area should be thoroughly investigated in an effort to obtain a satisfactory color match. If an exact match

Reason for Issue: To delete KW-8237 Empress Yellow for Tinting.

Supersedes: FP-873-18 dated 5/27/63.

cannot be made Sales should be asked to review the possibility of customer acceptance of the slightly different but more durable color.

If it is not possible to make the yellow with W-608 and W-630 then W-387 or W-686, Chrome Yellows are the preferred pigments and the same toning pigments may be used. However, even when chrome yellows are required the formulator should attempt to introduce as much W-608 and W-630 or into the formulation to promote better durability.

NOTE: Sales must be advised of alkali spot sensitivity if Chrome Yellows are used.

PIGMENT BLENDING PRACTICE

REDS:

The formulation of a complete range of reds is not considered necessary at this time since the red colors used in the stripcoating industry are generally limited to iron oxide type colors. Should the need for brighter red colors develop in the future, additions will be made to this 873-Line formulating practice. If a red color cannot be matched with the limited red pigments designated in this practice then the problem should be referred to the Marshall Development Laboratory which will issue additional red pigments.

(A) Dark Reds:

Dark reds in the 873-Line quality are classified as red colors with a maximum L = 40 reflectance value. Reds that fall in this category should be formulated a total prime P/B level equivalent to 80 per cent of the determined "L" value. If the "L" value is higher than 40 then the reds are formulated according to Section B or C.

W-355 and W-362, Red Iron Oxides, are the preferred pigments for formulating reds in this range and they may be toned with the following pigments:

- (1) W-50, Titanium Dioxide
- (2) W-253, Carbon Black
- (3) W-630, Ferrite Yellow

If the color cannot be matched with the preceding pigment combinations, the following toning pigments may be used.

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- (d) W-551, "Monastrol" Blue (Expensive)
- (e) W-819, "Monastrol" Red (Expensive)

(B) Medium Reds:

Medium reds are classified as red colors with an "L" value range from 41 to 60. Reds that fall in this category should be formulated at a total prime R/B ratio equivalent to 80 percent of the determined "L" value. If the reflectance value is less than 41 then formulate according to Section A, if greater than 60, in accordance with Section C.

For medium reds, the same preferred and toning pigments may be used as indicated under Section (A), Dark Reds.

(C) Light Reds

Light reds are classified as red colors with an "L" value greater than 60. These colors should be formulated according to the PIGMENT BLENDING PRACTICE, PINKS, CORALS, SALMONS, AND PASTEL ORANGES discussed in another section of PP-873.

(a) Vehicle Composition of 873-Line

The vehicle composition of the 873-line quality is based on the following resins in the ratio indicated:

	<u>SOLIDS BASIS</u>
RC-11102 Acrylamide	50.0
RC-478 DCO/CO Alkyd	10.0
G-359 W-552 Epon 1001	5.0
G-404 G-56 Polyethylene	3.0
	<u>108.0</u>

Although G-56 is normally considered as a modifying agent it has been included in the 873-Line as an integral part of the binder for simplification purposes; since it is to be controlled at the specific amount indicated in all 873-Line products.

(b) Modifying Agents:

At the present moment there are no modifying agents employed in the 873-Line other than the G-56 discussed above and

For $\alpha = 1$, the Euler characteristic is $\chi(\mathbb{P}^1 \times \mathbb{P}^1) = 4$, and the first Chern class is $c_1 = 2$, consistent with the $\mathbb{P}^1$ -bundle.

100-200000

[illegible]

(c) Specifications:

Specifications for the 873-Line quality are covered in the STP-330. It is the responsibility of the Sales Department to advise formulating laboratories of special customer requirements such as material glass specifications, etc.

IV. Formulating Theories

4. Specific Formulating Tables have been prepared for the 973-Line. However, as a matter of convenience, a table has been attached to #9-973 designated APPENDIX A. This table gives pertinent information concerning the 901-Line mill bases and is developing 973-Line emulsions. Data such as % pigment, % binder, solids, gallons volatile, etc. are included. In the event that the 901-Line mill bases are added or revised by the various formulating laboratories it is important that the table in APPENDIX A also be revised by the laboratory responsible for the addition or revision. The Marshall Development Laboratory should be advised immediately of any changes regarding the 901-Line mill bases.

CONCLUSIONS AND RECOMMENDATIONS

Plastics cards should indicate under Manufacturing Information the following information:

(1) REACTIVE WITH ZINC or HOT Carbonates

THIS FORMULA BLEND, where blending percentages are used.

VI. REASON FOR ISSUE.

To provide a formulating guide for the laboratories involved in formulating 873-line products.

MARSHALL DEVELOPMENT LABORATORY

L. W. Hamilton

L. W. HAMILTON

LWH:ms
4/30/63

APPENDIX A
3/27/63

APPENDIX A

Code	% Pigment	% Resin Solids	Gallon Weight	Gallon Volatile/100 lbs.
902-224	7.0	20.0	7.97	9.89
902-253	7.0	27.5	8.03	8.96
902-355	49.0	18.3	12.92	4.54
902-362	46.0	15.9	12.39	5.21
902-551	11.1	25.2	8.09	8.71
902-582	15.0	27.2	8.82	7.98
902-608	48.0	17.3	12.68	4.79
902-622	43.0	20.8	12.15	5.02
902-630	32.0	25.0	10.38	5.95
902-679	48.0	19.2	12.97	4.54
902-686	48.0	19.2	13.02	4.54
902-687	42.0	20.3	11.98	5.20
902-750	11.1	25.4	8.14	8.67
902-754	50.0	16.5	13.13	4.69
902-819	9.0	22.0	7.97	9.40
902-5001	28.8	22.2	9.39	6.89
902-5007	66.7	6.9	15.75	3.68
902-17919	68.0	9.9	16.57	3.04
902-17920	11.9	18.0	7.35	10.08
902-17927	28.8	22.2	9.39	6.89
902-17930	68.0	9.9	16.38	3.11
902-W-80525	48.0	17.3	13.44	4.79

Reason for Issue: To add 902-W-80525
Supersedes: FP-873-23 dated 5/1/63

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