TECHNICAL INFORMATION ON BUILDING MATERIALS

TIBM-31

FOR USE IN THE DESIGN OF LOW-COST HOUSING

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PAINT PIGMENTS--BLACK, RED, AND LAKES

This is primarily a digest of the sections of Bureau of Standards Circular No. 69, "Paint and Varnish", (November 17, 1917),[1] and Technologic Paper No. 274, "Use of United States Government Specification Paints and Paint Materials", (December 15, 1924),[2] by P. H. Walker and E. F. Hickson, dealing with general composition, characteristics, and uses of black and red pigments, and lakes.

The following papers contain additional information relative to paint pigments, oil paints, and water paints:

TIBM - 30 "Paint Pigments--White"
TIBM - 32 "Paint Pigments--Yellow, Brown, Blue, Green, and Bronze"
TIBM - 33 "Federal Specification Paint Pigments and Mixing Formulas"
TIBM - 34 "Federal Specification Ready-Mixed Paints, Semi-paste Paints and Mixing Formulas"
TIBM - 35 "Preparation of Paints from Paste and Dry Pigments"
TIBM - 36 "Preparation of Paints from Semipaste Paints, Thinning Ready-Mixed Paints, and Preparation of Water Paints"
TIBM - 43 "Aluminum Paints"

Pigments are "the fine solid particles used in the preparation of paint, and substantially insoluble in the vehicle."[3] In general, it may be

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[1]Out of print. May be consulted in Government depository libraries.

[2]Available from Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 10 cents).

[3]Quoted from "Standard Definitions of Terms Relating to Paint Specifications", American Society for Testing Materials (1933), pp. 735-739.

assumed that pigments composed of very fine particles, having high refractive indices, provide the greatest covering power and opacity.

Lake: In paints a lake is "a special type of pigment consisting essentially of an organic soluble coloring matter combined more or less definitely with an inorganic base or carrier. It is characterized generally by a bright color and a more or less pronounced translucency when made into an oil paint."[1]

Federal Specifications are specifications adopted by the Federal Specifications Executive Committee and approved by the Director of Procurement, Treasury Department, for use of all departments and establishments of the Federal Government.[2]

Black Pigments--Lampblack

Production and General Composition: Lampblack is soot produced by the incomplete combustion of oils, fats, resins, or resinous woods. It is more or less pure carbon.

Characteristics: It is grayish black in color, very bulky, remarkably permanent, and has great color strength.

Use: Lampblack is largely used to produce a fine blue gray, by mixing it with white. It is also used as a solid color, although it is not so bright a black as some other pigments.

Federal Specification: See TT-L-71; "Lampblack; Dry, Paste-In-Japan, Paste-In-Oil."

Gas Black or Carbon Black

Production: Gas black is closely related to lampblack, and is produced in a similar manner though from natural gas.

Characteristics: It is far blacker looking than lampblack. With white, gas black gives a brownish or smoky tone to the gray which is not desirable. Both lampblack and gas black, when burnt, should not leave more than a small fraction of 1 percent residue.

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[1]Quoted from "Standard Definitions of Terms Relating to Paint Specifications", American Society for Testing Materials (1933), pp. 735-739.

[2]Copies of all Federal specifications mentioned in this digest may be obtained from Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 5 cents each).

Varieties: Thermatomic black and acetylene black are varieties of gas black of recent introduction.

Use: Gas black is used as a solid or body color and in printing inks.

Bone Black

Production and General Composition: Bone black is produced by heating bones in a retort from which the air is excluded. The resulting bone charcoal, which is ground fine, contains 10 to 20 percent carbon. The remainder is largely calcium phosphate. "Ivory black" or "Drop black" made from ivory chips and cuttings is a high grade bone black.

Characteristics: It is fine black in color. Its color strength may be not more than 1/8 as great as lampblack, and the gray it gives with white is not so pure. All kinds of bone black may contain Prussian blue, which is added to modify the color. A much stronger color may be made from bone black by removing the mineral matter with hydrochloric acid.

Use: Bone black is used as a body color.

Federal Specifications: See TT-B-601, "Bone-Black; Dry, Paste-In-Japan, Paste-In-Oil."

Charcoal Black

Production: Charcoal black is of vegetable origin and produced in the same manner as bone black. Sources--peach and plum pits, cocoanut shell, cork waste, and grapevine cuttings.

Use: The blue black or vine black grade made from grapevine cuttings is used by artists in water colors.

Graphite (Black Lead or Plumbage)

General Composition: Graphite is a form of carbon found as a natural mineral. That used in paint sometimes contains as much as 85 percent graphite, the remainder siliceous material. Sometimes silica or other pigments are added, thus reducing the graphite content of the pigment in a graphite paint to no more than 40 percent.

Characteristics: Graphite is extremely permanent. Its dull grayish black color renders it undesirable for any use except on inconspicuous surfaces. Acheson graphite is an artificial graphite of extremely fine texture, sometimes used in paints. This graphite may contain as little as 0.1 to 0.2 percent ash.

Graphite Paints: "Brown graphite", "green graphite", and "red graphite" paints are graphite paints with some other added coloring matter.

Use: Graphite is used largely in paints for iron roofs and other iron surfaces.

Black Oxide of Iron

Characteristics: This is an artificial pigment having the approximate composition of magnetic iron oxide. It is a soft, black, powder.

Use: It is used in anti-corrosive paints and in black cold water paints.

Miscellaneous Black Pigments

Types: Black mineral substances, such as coal, shale, etc., are ground and sold under a variety of names, such as "mineral black", "keystone filler", or "iron filler." Their use is generally confined to paints applied as fillers for rough surfaces.

Red Pigments--Indian Red

Production and General Composition: Indian red is produced artificially by roasting ferrous sulphate (green vitriol), which yields colcothar or rouge, of colors from bright scarlet to purplish red. It should contain at least 95 percent ferric oxide.

Characteristics: This pigment is of a dark purplish color, very permanent, and is not affected by light or by other pigments with which it is mixed. As a body color it is very opaque and may be extended by the addition of large proportions of inert material, and yet cover very well. "Turkey red" is the name given to iron oxides of bright red color.

Use: Indian red is used largely to afford pure tints with white.

Tuscan Red

Production: Best grades of Tuscan red are produced by enriching Indian red with an Alizarin lake dye. Cheaper dyes of inferior quality, and bases other than Indian red are sometimes used. However, the resulting colors soon fade and such products are worthless for special uses for which Tuscan red is adapted.

Characteristics: Tuscan red possesses a beautifully subdued crimson tone of great color strength, which is usually reduced by mixing it with barytes, whiting, or gypsum. It is very permanent and will stand temperatures as high as 300° to 350°F without changing.

Use: Tuscan reds are extensively used to withstand vigorous exposures. They are used for painting steam pipes, radiators, implements, machinery, and passenger cars.

Venetian Red

Production and General Composition: Better grades of Venetian red are produced by mixing calcined ferrous sulphate with gypsum. The calcined ferrous sulphate is mixed with barytes or whiting in the manufacture of inferior grades.

Characteristics: Good Venetian red is always brick red in color. It has excellent body and, if free from whiting, great permanency. It may be mixed safely with any other pigment. Cheap commercial calcined earth reds, which are not much more than clay possessing sufficient iron to color, and sold as Venetian reds should not be confused with high grade Venetian reds, as their use, except in cases where reduced cost is the sole object, is likely to lead to disappointment.

Use: Good Venetian red can be used for almost any kind of painting in oil or for "distemper" (water paint). It is very widely used when an inexpensive and reliable pigment is needed. However, as an exterior paint on metal, an iron oxide pigment with a siliceous base is generally preferred.

Red Lead

Production and General Composition: Red lead is produced by heating metallic lead forming lead monoxide (litharge) which is converted into red lead by additional heating. Pure red lead (Pb_3O_4) may be regarded as 1 part lead peroxide (PbO_2) and 2 parts lead monoxide (PbO). Painters' red lead contains 85 to 99 percent Pb_3O_4, the remainder of the unadulterated samples being lead monoxide unchanged in the manufacturing process. By a special fume process, red lead of exceeding fineness can be made. Red lead can be bought today which is guaranteed to contain at least 98 percent true red lead (Pb_3O_4).

Characteristics: Red lead is a brilliant scarlet red pigment. It is blackened by hydrogen sulphide or other sulphur compounds, and has a tendency to whiten upon exposure to atmospheric agencies. As its chief use is for first or priming coats, these defects are of no consequence.

Ordinary red lead, containing less than 95 percent Pb_3O_4, of itself, is a good drier. When mixed with oil it will solidify to a hard mass within a short time, therefore, it should be used immediately after, or at most, within 24 hours of mixing. The practice of grinding red lead to a paste form in a non-drying oil is not recommended. When ground mixed with other pigments, such as silica, it should not be sold as pure red lead.

There is a high grade red lead on the market containing about 98 percent Pb_3O_4 which, when ground in linseed oil to a paste form, does not harden in the container, and appears to be equal in every way to freshly mixed dry lead.

Red lead paint is very heavy, flows on stiffly, has a tendency to sag, and is not likely to cover as much surface as white lead. If properly prepared and applied it forms a very tough, adherent coating.

Orange Mineral is a form of red lead having a lower specific gravity and lighter color.

Use: Red lead is used for its protective action, and not as a color or for tinting purposes. Although it is probably the best, and most widely used pigment for priming coats on all kinds of surfaces, red lead is not commonly used for priming wood because of its color, which requires more coats to hide when white or light tints are desired than would be needed if light-colored pigments were used. For the protection of iron and steel from outdoor exposures, red lead linseed oil paints are probably the best. This paint should weigh not less than 25 pounds per gallon.

Federal Specifications: See TT-R-191, "Red-Lead; Dry and Paste-In-Oil." Avoid storing red lead paste in places of high temperature. Red lead should not be purchased in paste form unless it is to be used within three months after shipment by the contractor.

English Vermilion

General Composition: English vermilion is mercury sulphide.

Characteristics: It is very opaque, a beautiful scarlet, but not a very permanent color.

Use: English Vermilion is used principally for striping, but because of its high price, its place for other purposes has been taken by modern organic lakes.

American Vermilion (Scarlet Lead Chromate, Chrome Red)

General Composition: American vermilion is a basic chromate of lead.

Characteristics: It is a brilliant scarlet, coarsely crystalline powder, possessing good hiding power and color strength. It is fairly permanent to light, but is blackened by sulphides. Grinding turns it to a dull yellow.

Use: As a protective pigment in paints for iron and steel, American vermilion equals or excels red lead. However, cost prohibits its wide use. It is sometimes used as a color pigment, but for this purpose its place is largely taken by coal-tar reds.

Cadmium Red or Selenium Red

General Composition: Cadmium red or Selenium red is a red inorganic pigment of recent introduction. It is a manufactured pigment consisting of cadmium sulphide and cadmium selenide.

Characteristics: This is a brilliant red pigment of considerable opacity, and very stable to light.

Use: It is used in enamels.

Lakes

Production: Lakes are formed by combining the coloring matter of certain dyes with metallic bases. Most of the natural lakes are obsolete, the great bulk being prepared from synthetic (coal-tar) dyes.

Characteristics: In general they range in color through every shade of red, purple, and maroon. Lakes are brilliant, transparent, possess high color strength, but are frequently very fugitive to light.

Types:

Alizarin Lakes are produced artificially from coal-tar. They are very permanent, and possess fair hiding power especially if precipitated on an excess of opaque base.

Carmine Lakes are formed by combing carmine, the coloring matter of cochineal, with alumina. They are deep, fiery-scarlet powders, fugitive to light.

Rose Pink and Rose Lakes are made from brazilwood or artificial coal-tar dyes.

Artificial Vermilions: When properly made, artificial vermilions are very brilliant, and possess high color strength. They are more permanent than genuine English Vermilion, but do not have the same hiding power. Some are slightly soluble in oil, and have a tendency to bleed into other colors, especially white. Artificial vermilions in some cases are also injuriously acted upon by ammonia vapors and many pigments.

Permanent and satisfactory artificial vermilions are made from Alizarin as a lake, extended by red lead, blanc fixe, or whiting.

Red Organic Pigment Dyes: The introduction of synthetic dyes prepared from coal-tar, gave rise to the three following very important red organic pigment dyes. Toluidine toner is the best bright red pigment at the paint manufacturer's disposal (See Federal Specification TT-E-531a).

Paranitraniline red is an excellent red pigment dye. Lithol red is another good, red pigment dye.

Tungstate-Molybdate Lakes: Such lakes have appeared quite recently in red, green, yellow, and blue. They are being used in the printing ink industry, and to some extent by paint manufacturers to keep green and blue tints from changing color in the container.