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A PROPOSED SYSTEM OF CLASSIFICATION  
FOR HOUSE PAINTS

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## A PROPOSED SYSTEM OF CLASSIFICATION

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The system of classifying house paints described herein is a gradual development over a period of approximately 5 years since its original conception. During that time it has been used for guidance in formulating paints for the studies of the Forest Products Laboratory, for advising correspondents about the relative merits of commercial paint formulas, and for studying the causes of early failures of paints on houses. The details have been elaborated and minor changes made as experience suggested until it now seems adequately rounded out for presentation as far as white paints and tinted paints, especially those with vehicles of unbodied drying oils, are concerned. Although the same principles may be applied to classification of house paints made predominantly of colored pigments, paints of that kind will not be considered at this time.

The system of classification was presented before the New York Paint and Varnish Production Club on September 17, 1936. It was prepared for publication in February 1937 and submitted for criticism to a number of paint technologists. The manuscript has been revised in the light of the comments received and, although the writer is unable to accept all of the suggestions made, he has tried to indicate clearly the points upon which serious conflicts of opinion remain unreconciled.

#### Why Classification is Needed

Systematic classification of house paints is needed both for the progress of paint technology toward improvement of paints and for the education of painters and the public in the proper use of the paints already available. Research in the formulation of paints remains almost wholly empirical, preoccupied with the rivalries between competing raw

materials, and dominated by the idea that the goodness or badness of a paint can be determined entirely on its own merits without regard for other paints on the market and the various maintenance programs in which it will be used. Exposure tests are evaluated principally from the manufacturer's point of view, which often is not that of the house owner (2), and are too largely confined to the initial painting of new lumber. A systematic classification of paints directed toward the conditions that determine their successful use should stimulate the development of basic generalizations to replace empiricism in formulation and should broaden the scope of paint technology by emphasizing the mutual interest of manufacturer, painter, and owner in defining more closely the conditions for successful use of each kind of paint.

Classification is needed for effective education of painters and the public in the technic of application and maintenance. Paints as now sold represent a great range in proportions of pigments and liquids, in consistency, and in the proportions in which the makers advise that they be thinner for application. When the directions given by various manufacturers of similar paints are compared they are found to vary widely and without recognizable relation to the composition of the paints. The result is that painters tend to ignore manufacturers' instructions and to thin paints according to their own ideas but without understanding of the nature of the paint.

Modern paints likewise vary widely in important characteristics affecting their proper maintenance. Some paints may be neglected after they wear out without serious consequences while others, possibly of superior performance during their period of durability, must be repainted before they break up very much; some paints erode fairly rapidly during weathering and will stand more paint at each recoating than others that erode very slowly; some paints are more suitable than others for maintenance programs involving occasional washing to remove dirt. Owners on their part differ widely in their programs of paint maintenance and for the most part remain uninstructed in the important part of the responsibility for good service that is necessarily theirs. Since no one paint can be expected to prove wholly satisfactory for all programs of maintenance, an adequate classification of paints is a necessary means of harmoniously linking together the kind of paint and the kind of maintenance program. Without such classification attempts to teach painters and paint users how to maintain coatings with reasonable assurance of satisfaction must remain hampered by technical detail about paint composition (3) or evasive of the major issues (25).

At the present time each paint job on a house is treated as a separate transaction independent of preceding and succeeding paint jobs although the owner's real interest is in a coating maintained intact and of good appearance over a long period of years, usually without the expense of complete removal at any time. The present practices of the trade are based on the assumption that a good house paint properly applied over a previous paint in suitable condition will give its normal performance regardless of the nature of the previous paint. That this assumption may not always be sound was recognized as early as 1911 (26). The writer's observations of house owners' complaints about unsatisfactory paint service (4, 7) as well as some of his exposure tests (5) indicate that indiscriminate use of different kinds of paint for successive paintings is a common cause of difficulty even though each of the paints used is a good paint when used consistently. Most paint technologists, however, disagree with that opinion except that a number of them recognize that it is often unsafe to apply white paint over previous colored pigment paints containing neither white lead nor zinc oxide. If the writer's opinion proves to be correct some recognized classification of paints will be necessary to guide programs of paint maintenance so that incompatible combinations of paint may be avoided.

It should be pointed out that the writer's principle of compatibility does not assume that all painting on a given surface must be done with the same kind of paint. The facts now available prove that certain combinations of dissimilar paints, such for example as white or colored paints over aluminum primer or certain commercial paints over special primers made to go with them, give reliable service. On the other hand, certain combinations of dissimilar paints have repeatedly been involved in early failures both on houses and in exposure tests. Conservative procedure, therefore, suggests that combinations of dissimilar paints be avoided when they are not yet known to be justified by successful experience.

The writer has been criticized for exaggerating the extent to which property owners are having difficulty with the maintenance of paint coatings. It is asserted that justifiable complaints received by paint manufacturers from their customers amount to a small fraction of 1 percent of the paint sold (19). In the one city of Madison, Wisconsin, however, the writer's opinion about the causes and remedies for unreasonably early paint failures has been sought by the owners of several percent of the frame houses in that city and he sees many houses on which paint has served unsatisfactorily being covered with materials that are not painted. The loss of public confidence arising from failures has been commented upon by representatives of the paint industry (20) and supplies the appeal to fear in advertising addressed both to paint makers (11) and to the public (28). Explanations and warnings against bad painting practices have been published frequently over a long period of years (15, 20, 23, 29). Not long ago one of the largest paint manufacturers devoted much advertising to the theme, "end painting mistakes." Reliable statistics of the extent and nature of unsatisfactory paint service are greatly to be desired but the

evidence already available indicates clearly that it is far too common and that serious effort on the part of technologists to make satisfactory paint service more easily and more certainly attainable by the consumer is abundantly justified.

#### Distinction Between Classification and Specification

The distinction between classification of paints and specifications for paints apparently needs emphasis. Specification has for its object the exclusion of products below some chosen standard of performance. A good specification sets limits within which any product may be expected to have the desired utility. The limits should be as wide as is consistent with the objective but they must not be wide enough to admit undesirable products even though they exclude some that would be acceptable. Although the Federal Specifications Board has three specifications for white exterior paints very few of the many good white paints on the market fall within the limits of any one of them. Because of the lack of a rapid physical method of determining durability, specifications for paint deal largely with composition but they must likewise include provisions to ensure that the paint is properly manufactured in accordance with the formula and has suitable physical properties. Specifications are used chiefly for large purchases by government units or corporations. The public generally buys paint identified by manufacturer's trade brand, in which case the manufacturer takes full responsibility for the quality of the product. In the writer's opinion the public has no difficulty in buying good paint under this system; its difficulty lies in obtaining reliably serviceable coatings from good paints.

Classification, in contrast to specification, is not concerned with the quality of the individual product. It is concerned with identifying the product with respect to those characteristics that determine how it should be applied and maintained to obtain the best results of which it is capable. It is a foundation upon which to build a technology of paint maintenance to supplement the technology of paint manufacture and a means of relieving craftsmanship of a complex technical burden that laymen can never be expected to carry. An adequate system of classification must take cognizance of all kinds of paint on the market and include logical provision for new kinds that may appear later. It does not circumscribe limits about acceptable products to the exclusion of all others but rather it marks off the entire field of products into subdivisions of like characteristics and utility but without prejudice for or against any of the subdivisions. To be sure, individuals may have personal preferences for some subdivisions over others and some subdivisions may represent more expensive paints than others but classification in principle imposes no appraisal of relative merit.

## Volume Analysis of Paint Formulas

The characteristics of a house paint are determined by the nature and proportions of its pigments, the nature and proportions of its liquids, and the concentration of total pigments. The conventional formula in percentages by weight, which originated in the convenience of the analyst and factory superintendent rather than in technology, tends to obscure the relations because of the wide variation in specific gravity of the ingredients of paint. There has long been a growing realization among technologists that the formula expressed in percentages by volume is far more significant than the formula by weight.

In the early exposure tests at North Dakota Agricultural College in 1906 and at Atlantic City and Pittsburgh in 1907, the concentration of total pigment in the paints varied unsystematically and evidently was considered unimportant (10, 13, 14, 30, 33). Years later Galbeck (9), following an old theory of MacGregor (27), reworked the data for the tests at North Dakota and pointed out a close connection between content of total pigment by volume and durability of the paints. In an early test by Subcommittee D-1 of the American Society for Testing Materials, mixtures of pigments were planned by volume but the proportions of total pigment were established by adding oil until the paint attained an arbitrarily chosen viscosity (34). Recent studies suggest that measurement of the consistency of paint as a function of the content of total pigment by volume leads to a "critical point" that is optimum not only for brushing properties but also for durability (12). At the present time some of the more experienced technologists make paints for comparative exposure tests with a constant proportion of total pigment by volume (1, 24) and examination of commercial paints during the past decade or two reveals a general trend toward a higher content of total pigment by volume than was customary in the past.

Most of the useful properties of paint are determined, at least to a first approximation, by the proportions of ingredients by volume. Volume, not weight, governs the area coverable with a film of suitable thickness, the concentration of opaque pigments in the film necessary to hide the surface, and the concentration of total pigments required both for good consistency for application and for optimum durability. Presumably, the factors of composition that control the compatibility of paints used successively likewise are expressible in terms of proportions by volume. The first step in the proposed system of classifying paints, therefore, is to convert the formulas of paints by weight to the formulas by volume, a recalculation that for convenience is called volume analysis.

## Basic Principles of the Proposed Classification

Until comparatively recently, the nonvolatile liquids in all except some cheap paints consisted essentially of unbodied drying oils, usually linseed oil, containing small additions of driers while the volatile liquids were turpentine, mineral spirits, and water. Substitution of moderate proportions, say 10 percent, of bodied for unbodied drying oils has become fairly common but so long as it does not impart properties of enamel rather than of paint there seems to be no reason for believing that the characteristics of the paint affecting its use and consequently its classification are thereby altered. The "enamelized", "resin-fortified", and "quick-drying" house paints that have appeared in recent years, however, call for distinction from the true house paints in classification but as yet remain relatively unimportant commercially. The differences in the nature and amount of the pigments remain the center of interest in formulation of house paints and the principal basis for classifying them.

Among the white pigments the zinc oxides and the white leads are generally recognized as "chemically active" pigments in that they profoundly affect the conversion of the liquid drying oils to solid oxyns (31) and impart distinctive properties to the resulting coating. Zinc oxide acts as a hardening agent in paint (8). White lead keeps paint tough and distensible to a late stage in its life (22). Lead titanate, though said to be chemically inert, imparts the same properties to paint (32) and probably should be grouped with the white leads. The titanium pigments and the zinc sulfide pigments are chemically inert (21) as are also the transparent pigments with the possible exception of calcium and magnesium carbonates. The fact that the lead, zinc oxide, and chemically inert pigments differ profoundly in their effects on the behavior of paint is firmly established empirically even though the chemistry of the reactions with the drying oils is still imperfectly understood. For these reasons a classification of the white paints should separate them into groups of reasonably uniform content of the two kinds of chemically active pigments.

From the point of view of opacity of the paint distinction must be drawn between the transparent pigments, the opaque white pigments, and the very opaque white pigments. The transparent pigments, such as silica, the silicates, barium sulfate, and calcium carbonate, add practically nothing to the opacity of the paint, though they are often very useful in building up an optimum content of total pigment for good consistency and durability. The opaque white pigments include the white leads, the zinc oxides and leaded zinc oxides, titanium-barium pigment, lithopone, and antimony oxide. The very opaque white pigments include titanium dioxide, lead titanate, zinc sulfide, the high-strength lithopones, and titanated lithopone.

In the proposed system of classification house paints made with unbodied drying oils are separated into groups of types depending upon the

nature of the opaque white pigments, into types depending upon the proportions of the chemically active pigments, and into divisions depending upon the concentration of opaque white pigments, total pigments, and total nonvolatile in the paint. Identification both by type and by division follow naturally out of practices of the paint industry even though these practices have never been formally recognized. Technologists for some time have distinguished informally between the lead-zinc paints, the titanium-lead-zinc paints, the lithopone-lead-zinc paints, leadless paints, etc. These designations correspond to the groups of types of the proposed classification. Frequent use of such terms as high lead content, high or low zinc content, in the technical literature bespeaks the need of further subdivision of the groups into types. The common expressions high grade and low grade or first grade and second grade indicate the need of separating each type into divisions. It should be emphasized that the divisions are necessary further refinements in classification within each type. Within the limits of some one type, comparison of the divisions is meaningful, but until the type of paint has been specified, no comparison of divisions is significant. Type and division of paint are bound together in a manner similar to the relation between species and grade in the classification of lumber.

#### Details of the Proposed Classification

Table 1 illustrates the application of the proposed system of classification to 30 commercial paints made by well-known manufacturers. These thirty, which are selected from more than 100 prepared paints and 50 paste paints examined, are believed to represent fairly the present range in formulation of prepared white and tinted paints in which the vehicle is predominantly unbodied drying oil. Enamelized, quick-drying, and most resin-fortified paints are excluded. Paint No. 30 is moderately fortified with resin but contains no zinc oxide and has the properties of a true house paint. The use of resin in cheap paints, such as Paints 23, 27, and 28, follows a long tradition of the industry.

In Table 1 the formula of each paint is given first in the manner in which it is commonly expressed on formula labels. The total pigment and total liquid are expressed as percentages of the paint by weight and the individual pigments and individual liquids as percentages by weight of the total pigment and of the total liquid, respectively. Under the formula by weight for each paint appears the volume analysis of the formula, that is, the fraction of a gallon of each ingredient in 1 gallon of the paint. If multiplied by 100 these figures become percentages by volume. The volume analysis is calculated by much the same procedure that is commonly followed in computing the yield in gallons of formulas expressed by weight (16). The number of pounds of each ingredient is multiplied by the published bulking value of the ingredient in gallons per pound (17) to find the yield of each in gallons, which is then divided by the total yield.





In the volume analysis subtotals are struck for total opaque pigments, total pigments, and total nonvolatile. When the very opaque pigments are used a sufficient amount of dilution with transparent pigment is included in the subtotal for total opaque pigments to yield the same subtotal that would have been obtained if titanium-barium pigment (25 percent  $TiO_2$ ) or regular lithopone (28 percent ZnS) had been used to provide the same quantity of titanium dioxide or of zinc sulfide, respectively. Thus in Paint 12 the pigment contains 0.035 gallon of titanium dioxide for which 0.091 gallon of diluent is counted as opaque pigment because 0.126 gallon (0.035 + 0.091) of titanium-barium pigment would be required to provide the same amount of titanium dioxide. The diluent for titanium dioxide is calculated by multiplying the volume of titanium dioxide by the factor 2.6 (0.035 x 2.6 = 0.091). The factors for the very opaque pigments are:

Lead titanate.....	3.0
Titanium dioxide.....	2.6
Zinc sulfide.....	2.3
Lithopone, high strength (50 percent ZnS and $BaSO_4$ )....	.75
Lithopone, titanated (15 percent $TiO_2$ ).....	.5
Lithopone, high strength (50 percent ZnS and talc).....	.4

The diluent for very opaque pigments is counted in the subtotal for total opaque pigments only. The subtotal for total pigments includes only the opaque and transparent pigments actually present. If less transparent pigment than the allowable diluent for very opaque pigments is used the total opaque pigments may exceed the total pigments, which is the case in Paints 12, 14, 16, and 24 but not in Paints 21 and 27. The subtotal for total nonvolatile is, of course, the sum of the total pigments, unbodied and bodied drying oils, and resins. Paint driers contain a relatively small proportion of nonvolatile but inasmuch as the conventional paint formulas rarely report the nonvolatile part of the drier it seems best to count the drier entirely as volatile liquid for the present. The error involved is small and the procedure has already become customary in paint technology.

Under the volume analysis of each paint in Table 1 are given certain characteristics of the paint that lead to its assignment to one of the types and divisions listed in Table 2. The group of types is indicated by letter symbols representing the nature of the opaque white pigments, L standing for white lead or lead titanate, Z for zinc oxide, T for titanium pigment, and S for zinc sulfide pigment. Six groups may be recognized: (1) White lead and zinc oxide paints of the "100 percent pure" variety in which there is no transparent pigment, symbol LZ; (2) white lead and zinc oxide paints containing transparent pigments, symbol (LZ)<sub>n</sub>; (3) titanium pigment, white lead, and zinc oxide paints, symbol TLZ; (4) zinc sulfide pigment, white lead, and zinc oxide paints with or

Table 2.--Types of unbodied drying oil house paints found on the market and distribution of 102 commercial paints by type and division

Description of paint types				Number of commercial paints of division indicated						
Ref-er-ence No.*	Group	Range in content of zinc oxide	Range in content of white lead	Division						
				L	M	N	O	P	Q	All divisions
1	LZ	Very high, over 50	High, 36-50				2			2
2	LZ	High, 36-50	Very high, over 50			2				2
3	(LZ) <sub>n</sub>	High, 36-50	High, 36-50	2	1					3
4	(LZ) <sub>n</sub>	High, 36-50	Medium, 25-35					1		1
5	LZ;(LZ) <sub>n</sub>	Medium, 25-35	Very high, over 50	3	3	1				7
6	(LZ) <sub>n</sub>	Medium, 25-35	High, 36-50	2	5	1				8
7	(LZ) <sub>n</sub>	Medium, 25-35	Very low, under 10					1		1
8	LZ;(LZ) <sub>n</sub>	Low, 10-24	Very high, over 50	1	2					3
9	LZ	Low, 10-24	Low, 10-24					2		2
29										
10	TLZ	High, 36-50	Low, 10-24			1				1
11	TLZ	Medium, 25-35	High, 36-50	4	1	1				6
12	TLZ	Medium, 25-35	Medium, 25-35	1		1	1			3
13	TLZ	Medium, 25-35	Low, 10-24	4						4
14	TLZ	Low, 10-24	High, 36-50	1	1	1				3
15	TLZ	Low, 10-24	Medium, 25-35	1	3					4
16	TLZ	Low, 10-24	Low, 10-24		2	4	1			7
28										
17	SLZ	Medium, 25-35	Medium, 25-35			1				1
18	SLZ	Low, 10-24	Low, 10-24			3	4	2		9
19	SLZ	Low, 10-24	Very low, under 10	2	1	2	5	1		11
20	SLZ	Very low, under 10	Very low, under 10					3		3
24										
21	Leadless	Medium, 25-35	None		1		2	1		4
22	Leadless	Low, 10-24	None			2	4	3		9
23	Leadless	Very low, under 10	None				1	1	4	6
19										
24	Zinc-less	None	Very high, over 50	1						1
25**	Zincless	None	High 36-50	1						1
										2
										102

\*The numbers are intended for cross reference to Table 1 only and are not to be permanently associated with the types.

\*\*This type is moderately fortified with resin.

without titanium pigment in addition, symbols STLZ and SLZ; (5) lead-less paints, symbols TZ, SZ, STZ, and in cheap paints S and ST; (6) zinc-less paints, symbols L and TL. The advertising claims under which the LZ paints appear in commerce make it necessary to recognize them as a group distinct from the (LZ)<sub>n</sub> paints; from the strictly technologic point of view alone one group would suffice for them both. For reasons already discussed the proportions by volume of zinc oxide and of white lead or lead titanate in the total pigment are considered important characteristics which, together with the group, determine the classification by type. Valuable supplementary information about the nature of the paint is offered by the percentage of opaque pigments in the total pigments by volume and the percentage of total pigments in the total nonvolatile by volume. The last two lines of Table 1 indicate the type as listed in Table 2 and the division within that type to which the paint is assigned.

Within each group of types the content of white lead and of zinc oxide in the total pigment varies very widely: This is particularly true of groups LZ and (LZ)<sub>n</sub>. Subdivision of the groups into types is therefore necessary but, for the present at least, the subdivisions must be drawn arbitrarily. For white lead and zinc oxide separately five ranges in percentage of the total pigment by volume are set up as follows:

Very high range.....over 50 percent  
High range.....36 to 50 percent  
Medium range.....25 to 35 percent  
Low range.....10 to 24 percent  
Very low range.....below 10 percent

A type of paint is defined by the group, range of zinc oxide, and range of white lead. With six groups and five ranges for zinc oxide and white lead more than 90 types of paint might be possible. (The combinations of 6, 5, and 5 are, of course, 150 but the facts that in LZ paints the lead and zinc pigments must total 100 and that one group contains no lead and another no zinc oxide materially reduces the possible combinations.) Not all of the types theoretically possible are practicable. Apparently the paints now on the market represent not many more than 25 of the possible types. Table 2 lists 25 types and indicates the distribution of 102 commercial prepared paints both by type and grade. Most of the nationally known brands and many brands of smaller manufacturers are included in the 102. It is probable, of course, that examination of a still larger number of commercial paints would reveal a few more types not listed in Table 2.

The assignment of a paint to a division within its type depends upon the following rules:

		Minimum content of --		
Division of paint	-----			
	Opaque pigments	Total pigments	Total nonvolatile	
		<u>In gallon per gallon of paint</u>		
L	0.25	0.25	0.89	
M	.21	.23	.82	
N	.17	.21	.75	
O	.13	.19	.67	
P	.09	.17	.60	
Q	---	---	---	
	:	:	:	:

In applying these rules no paint is placed more than one division below the division to which it would be entitled by its opaque pigments unless both total pigments and total nonvolatile are below that division, in which case it is placed two divisions below. Paint No. 1, for example, with 0.183 gallon of opaque pigments, 0.183 gallon of total pigments, and 0.877 gallon of nonvolatile, falls in division N with respect to opaque pigments, P with respect to total pigments, and M with respect to nonvolatile and is therefore placed in division O rather than division P. Twenty-three of the 30 paints fall in the division to which they would be assigned with respect to opaque pigments alone while the remaining six paints are placed one division below because either the total pigments, total nonvolatile, or both fall in the lower division.

#### Application to Paste Paints and Enamelized Paints

The discussion so far has been confined to prepared paints. According to the traditional terminology of the industry prepared paints, when stirred to uniform suspension, are of suitable consistency for application as finish coats without any addition of liquids (18). Paste paints, on the other hand, are concentrates calling for considerable addition of linseed oil, thinner, and sometimes drier. Paste paints may be brought within the scope of the proposed system by calculating the volume analysis for the paint after it is thinned in accordance with the manufacturer's directions for finish coat. Paint No. 29 in Table 1 is a paste paint classified in that way. A few prepared paints in recent years have appeared on the market in a consistency intermediate between that of paste paints and paint ready for application. Such paints might properly be called semiprepared paints but in any case the volume analysis should be calculated for the paint after thinning as directed for finish coat.

Inclusion of enamelized and quick-drying house paints would add materially to the number of types listed in Table 2. Even where the

composition of the pigment falls within the range of one of the types there indicated a separate type should be recognized because of the differences both in the nature of the liquids and in the physical properties of the paints. In many cases, however, the change in the liquid necessitates significant changes in the pigments. Replacement of unbodied drying oil with bodied oil or varnish tends to alter consistency in such a way that the content of total pigment in the paint must be diminished, the proportion of opaque pigment in the total pigment increased, and the content of total nonvolatile in the paint diminished. Moreover, if bodied oil without resin is used in the vehicle to make enamelled paint the content of zinc oxide in the pigment is sometimes unusually high while if resin is used the zinc oxide content must often be closely restricted. The enamelled paints differ from true house paints in fundamental physical properties affecting their use (6) to such an extent that sharp differentiation from true paints is essential. The quick-drying paints, unless they are likewise enamelled, resemble the true paints more closely though they should be recognized as separate types.

#### Symbols for Representing Paints

In the text of the five preceding paragraphs the letter symbols for the groups are used with obvious advantages for clarity and brevity of exposition. If some system of classification is adopted by the paint industry such symbols may prove convenient in identifying marks to indicate the types of paints to purchasers. One manufacturer, in fact, now uses the symbol LTZ for his "lead, titanium, and zinc" paint, though not as part of the trade mark. For such purposes the symbols must be very simple. Both LZ and (LZ)<sub>n</sub> groups would probably be written LZ. The essential declarations on the label of containers of paint would be written in some such language as the following:

\_\_\_\_\_ Brand Exterior House Paint  
Color -- White  
Type -- TLZ, low content of zinc oxide,  
medium content of white lead  
Division A  
Classified according to the standards of  
the \_\_\_\_\_ Association

The complicated statement of formula as now expressed on many labels could be omitted entirely as soon as the states having formula labeling laws could be persuaded to recognize the new system of classification.

For use by technical men, however, the letter symbols may be elaborated to great advantage in keeping records and making reports. Paint No. 1 in Table 1, for example, is written LZ<sub>55</sub>. p/nv 21, indicating that the pigment contains 55 percent zinc oxide by volume and that the total pigment is 21 percent of the total nonvolatile by volume. Since the

pigment consists entirely of white lead and zinc oxide it is unnecessary to write the subscript 45 to symbol L. Paint No. 3 is written (LZ<sub>40</sub>)<sub>84</sub>, p/nv 28, subscript 84 indicating that the white lead and zinc oxide together amount to 84 percent of the total pigment by volume; the white lead is therefore 44 percent. Paint No. 12 is written (TL<sub>40Z</sub><sub>28</sub>)<sub>118</sub>, p/nv 28, subscript 118 indicating that the total opaque pigments exceed the total pigments because of the convention adopted for the very opaque pigments. Paint No. 30 is written TL<sub>39</sub>(f), p/nv 30, the symbol (f) indicating that it is a resin-fortified paint. An enamelled paint made with bodied oil and no resin is written (TZ<sub>67</sub>)<sub>186</sub> (e), p/nv 19, which represents a product now on the market. For enamelled paints containing resin symbol (re) is used in place of (e) and for quick-drying paints (q).

### Simplification Through Classification

The proposed system of classification has been criticized on the ground of impracticable complexity. The complexity, however, resides in the great variety of paints on the market, not in unnecessary details of classification. In the writer's opinion it is the complexity of modern paints coupled with the lack of a common language in which to speak about paint that keeps paint technology almost wholly empirical, keeps differences of opinion among technologists alive indefinitely, and makes it increasingly difficult for painters to apply and owners to maintain paint satisfactorily. A classification that fails to reflect the complexity of the present situation cannot be expected to exert an influence toward the simplification essential for rebuilding craftsmanship and public understanding of paint and paint maintenance. The classification proposed here is simple enough in its basic principles and method of approach to bring the diverse kinds of house paint under a common logic and is far more intelligible to laymen than the present formula label in percentages by weight, which in itself is an important step in the direction of simplification.

The writer believes that the proposed classification should prove of immediate value to paint technologists particularly in that it should aid in broadening the field of technical research beyond the making of inherently serviceable paints to include as well the still more important problem of demonstrating clearly how painters and the public may be taught to get from modern paints the good service of which they are capable. In due time, when the paint industry has become convinced of its necessity and more technical data are available on such questions as the extent to which paints of different composition are compatible with one another, the writer believes that this or some better system of classifying paints for use will be found desirable in the sale of paints to the public. It should be remembered, however, that the ultimate value to the public and to the industry lies not in the mere classification of paints but in the educational program in proper application and maintenance of paint thereby made possible.

Any attempt to apply classification to the sale of paints would certainly begin with elimination of a large proportion of the types and divisions of paints recorded in Table 2. Their present unwieldy number cannot be justified by any consideration of the needs of different maintenance programs, peculiar conditions of service, or reasonable prejudices of users. Simplification of types and divisions of paints should be as feasible as the simplification in number of colors and sizes of packages effected some years ago. With a limited number of types and divisions of paint clearly identified in the trade an effective program of education of painters and paint users in correct methods of applying paints and safe methods of maintaining paint coatings becomes possible. Without some method of describing paints adequately painting and paint maintenance must remain too intricately technical to be understood by laymen. Since we can hardly expect to make technologists of painters and house owners we must find means of making paint simple enough for craftsmen and the public to use intelligently.



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